VOLUME 33 NUMBER 9 SEPTEMBER 1950

AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

CONTENTS

ACTH and Cortisone in ocular disease ..... *Alan C. Woods* 1325
Chemistry of pituitary principles ..... *Albert A. Dietz, Ernst Schmerl, and Bernhard Steinberg* 1349
Statistical review of glaucoma ..... *Albert N. Lemoine, Jr.* 1353
The problem of glaucoma ..... *Herman Elwyn* 1373
Separation of diencephalic centers ... *Ernst Schmerl and Bernhard Steinberg* 1379
Social and medical aspects of glaucoma ..... *Daniel Kravitz* 1381
Trephining operations ..... *J. Alexander Van Heuven* 1387
Visual fields in glaucoma prognosis . *Adolph Posner and Abraham Schlossman* 1391
Iridoschisis as a cause of glaucoma ..... *Clement McCulloch* 1398
Nevus flammeus with glaucoma ..... *Harold H. Joy* 1401
Lysozyme in ophthalmic conditions ..... *Carl Hobart* 1409
Choroiditis simulating retrolental fibroplasia ..... *R. D. Harley and R. W. Mather* 1417
Lanolin and corneal healing ..... *Johanna C. Heerema and Jonas S. Friedenwald* 1421
Visual-field testing ..... *Louise H. Darley* 1428
Effect of tobacco in glaucoma ..... *Marion Macdonald Castagno* 1431
Adenocarcinoma of meibomian gland ..... *Marion L. Rice and Harold I. Lindeke* 1434
Milk-procaine in foreign-protein therapy ..... *John A. Cetner* 1437
Digitalis and visual disturbances ..... *Joseph V. M. Ross* 1438
Instrument for pterygium operation ..... *Paul Tower* 1439
Provocative tests for preglaucoma ..... *Paul Weinstein* 1442
Stereoscope attachments ..... *Emanuel Krimsky* 1444

DEPARTMENTS

Society Proceedings 1446
Editorials 1456
Correspondence 1458
Book Reviews 1460
Abstracts 1464
News Items 1495

For complete table of contents see advertising page xiii

Copyright, 1950, Ophthalmic Publishing Company, 664 North Michigan Avenue, Chicago 11, Illinois

Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars. Published monthly by the Ophthalmic Publishing Company. Subscription and Advertising Office: 664 North Michigan Avenue, Chicago 11, Illinois. Entered as second class matter at the post office at Menasha, Wisconsin.

TROUTMAN
INTEGRATED MAGNETIC IMPLANT

Developed by R. C. Troutman, M.D.

Integration of the Troutman magnetic implant is accomplished without the use of a pin attachment for direct transmission of motility, but through the use of a magnetic field which is created between the implant and the prosthesis by the use of magnets in both. This allows *complete coverage* of the implant by *Tenon's and the conjunctiva* and still maintains positive integration.

- **The simplicity of technique reduces surgical time.**
- **Complete coverage of the implant reduces secretion.**
- **Permanent (life-time) magnets are used.**
- **Either a stock or custom made prosthesis can be used.**

Description and surgical technique is available upon request.
Color films showing surgical technique will be loaned upon request to clinical groups.

THE MAKING AND FITTING OF ARTIFICIAL EYES ARE A SPECIALTY WITH US—NOT A SIDELINE

The finest in artificial eyes of plastic and glass made to order and stock

- Mail order selection service
- Our technicians travel to most principal cities
- Trained technicians to fit artificial eyes to all motility implants

Write us if you have any artificial eye problems with your patients.

CHICAGO
DETROIT
CLEVELAND
KANSAS CITY
MINNEAPOLIS
NEW ORLEANS
ST. LOUIS

Serving the Profession since 1851

NEW YORK
BALTIMORE
BOSTON
BUFFALO
PHILADELPHIA
PITTSBURGH
WASHINGTON

MAGER & GOUGELMAN, INC.

30 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS

How Old is this Lady?

SHURON'S Browline SENORA frame, choice of the fastidious woman for daytime wear.

The photographer who posed her will tell you *this*—she is actually younger- and smarter-looking with her glasses than without them. She has chosen the BROWLINE frame, and adopted the Shuron "Optical Wardrobe" idea —matching her eyewear to the occasion as carefully as she matches her clothes.

And if—as is likely at this age of life—she requires bifocals, you, the professional man who accepts the responsibility for correctly fitted glasses, will appreciate that "Browline" design gives much greater opportunity to place the reading segment exactly where it belongs.

SHURON'S Browline MIRAMAR frame, perfect companion to the mood of evening.

SHURON'S SHELLTEX sun glasses, good protection and good looks, at sports.

Your patients will appreciate an Optical Wardrobe presentation.

Shuron®

OPTICAL COMPANY, INC., GENEVA, N. Y.

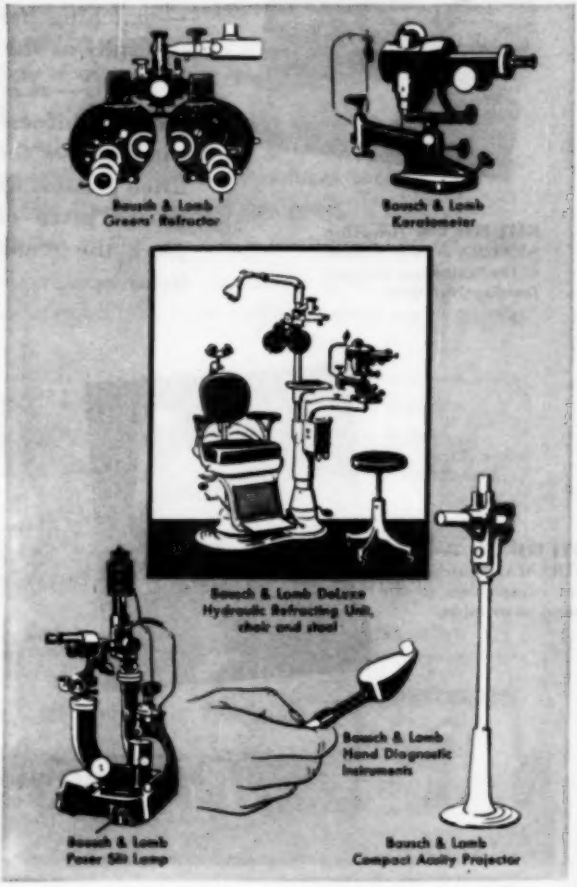
YOUR BEST PROFESSIONAL INVESTMENT

. . . for improved service

. . . for enhanced prestige

. . . for increased income

Keep patients relaxed, comfortable, cooperative. Conduct your refractions with efficiency, precision, freedom from distraction. Win patient recognition for your advanced professional procedure. Equip with the Bausch & Lomb Deluxe Refracting Unit—and modern Bausch & Lomb instruments. Your B&L distributor would like to arrange a private demonstration for you.


Bausch & Lomb Greens' Refractor
Bausch & Lomb Keratometer
Bausch & Lomb DeLuxe Hydraulic Refracting Unit, chair and stool
Bausch & Lomb Hand Diagnostic Instruments
Bausch & Lomb Power Slit Lamp
Bausch & Lomb Compact Acuity Projector

BAUSCH & LOMB

OPTICAL COMPANY ROCHESTER 2, N.Y.

A **MIOTIC** of Prolonged Action

with distinct advantages in the treatment of

GLAUCOMA

Floropryl (Di-isopropyl Fluorophosphate Merck) is recommended for the reduction of intra-ocular tension in glaucoma.

Floropryl is not only highly potent as an antagonist of cholinesterase, but its duration of action greatly exceeds that of pilocarpine or physostigmine, so that administration is required only at intervals of one to three days.

Effectiveness, infrequency of required application, prolonged action, and virtual freedom from systemic disturbance are characteristics that recommend Floropryl in many cases of glaucoma, and particularly in eyes that do not respond to other miotics.

AVAILABLE in 5 cc. dropper-bottles of a 0.1% solution in peanut oil.

LITERATURE containing full information on indications, pharmacology, side effects, and dosage is available on request.

MERCK & CO., INC.

MERCK

Manufacturing Chemists
RAHWAY, N. J.

Floropryl

TRADE-MARK

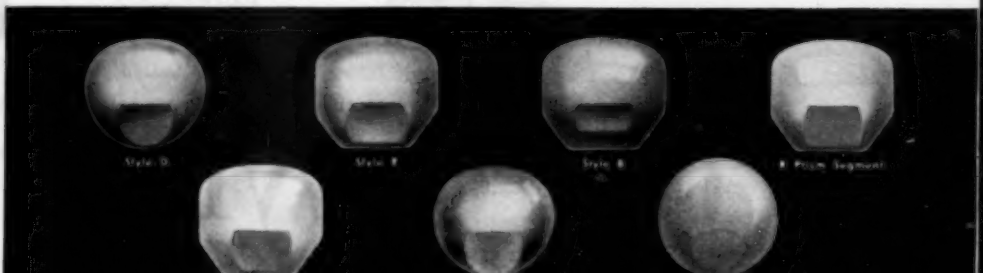
(Brand of Isoflurophate; DFP) (Di-isopropyl Fluorophosphate Merck)

Perfect

THE MOST POWERFUL practice-builders in the world are satisfied patients. What is a satisfied patient? A man who enters your office with some visual difficulty and who—as a result of your perfect visual analysis and prescription—leaves without it. That's what we mean when we say, *"Perfect makes practice."*

℞ Univis...the Complete

THE UNIVIS LENS COMPANY • DAYTON 1, OHIO



t makes Practice, too!

A word to the wise: don't neglect the vehicle that *carries out* your prescription—THE LENS. Thousands of doctors use the Univis Complete Multifocal Service for all presbyopic correction.

- **Fourteen lens styles permit widest possible range of prescription.**
- **Univis design has created the most functional lens to meet all refractive interpretations.**
- **Univis production processes and the recently introduced GG-7 guarantee standard quality on every lens you use.**
- **Efficient service on Univis speeds your own service.**

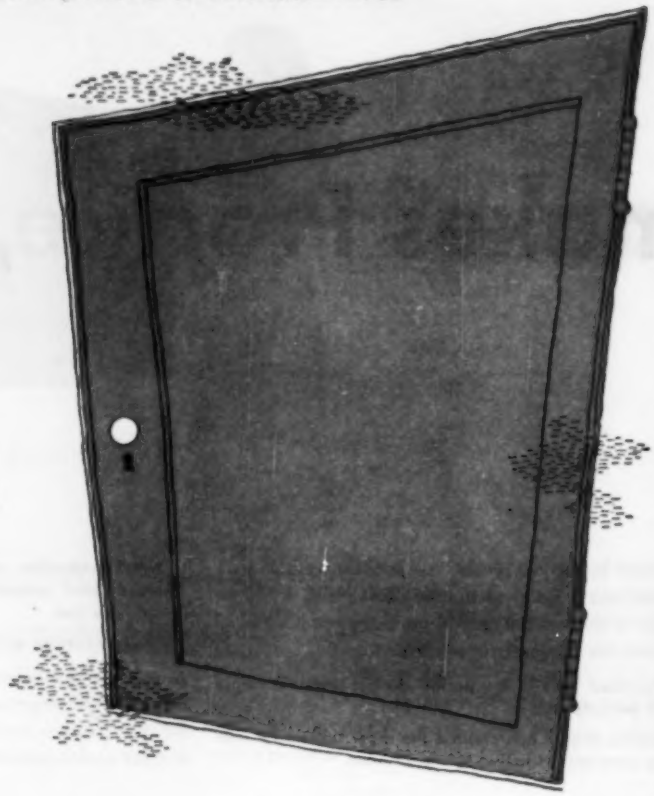
Any of the Univis lens styles you use will help transform your prescription into more nearly perfect vision for your patients. Isn't that what we're talking about? *Perfect makes practice.*

Multifocal Service UNIVIS

2-WAY® AND 3-WAY® LENSES

® Reg. U.S. Pat. Off.

there's a *friend* of yours outside

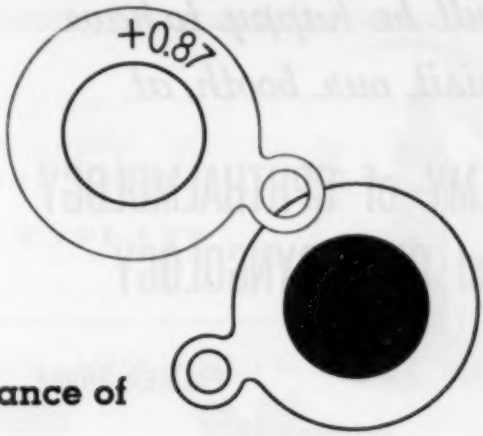


He is a specialist, *too*—in his own field. He is the supply house representative who calls regularly with data to help you better serve your patients. Just as you have prepared yourself for the professional field, he is prepared to give you helpful information regarding new materials and laboratory services. For example, there are many absorptive lens names—but *only one Soft-Lite!* How Soft-Lites are visibly different in the Comparator . . . how they are non-selective with charts that prove this point . . . how the Soft-Lite Trial Case Accessory fits into the doctor's refractive procedure—these are just a few ideas to discuss with your Soft-Lite supply house representative. His friendly co-operation can be valuable!

Soft-Lite Lenses

Worn With Comfort Since 1908

Featured in Orthogon and Panoptik



Announcing

Council Acceptance of

OPHTHALMIC SOLUTION

PAREDRINE HYDROBROMIDE* 1%

with Boric Acid

*hydroxyamphetamine hydrobromide, S.K.F.

an outstanding cycloplegic adjuvant and mydriatic

The 'Paredrine technique' in refraction saves the physician time and trouble and spares the patient prolonged visual disability. In the words of Harrison[1], it "has the advantage of maximum action with minimum duration." With children, the whole procedure can be carried out at the office; and the greatly reduced amount of atropine required for satisfactory cycloplegia lessens the probability of toxic side effects.

Advantages:

1. requires only a minimum number of instillations
2. helps achieve rapid cycloplegia
3. permits accurate refraction
4. assures a quick return of accommodation

Smith, Kline & French Laboratories, Philadelphia

1. Harrison, W. J.: Ocular Therapeutics, Springfield, Ill., Charles C Thomas

'Paredrine' T. M. Reg. U. S. Pat. Off.

We will be happy to have you visit our booth at

ACADEMY of OPHTHALMOLOGY and OTOLARYNGOLOGY

CHICAGO — PALMER HOUSE

October 8-13

check below items you are interested in seeing

ORTHOPTIC HEADQUARTERS

- ☐ TROPO-FLASH for the
- ☐ TROPOSCOPE—45B Model
- ☐ ROTOSCOPE—Royal 50
- ☐ ROTOSCOPE—DeLuxe
- ☐ DEVIOMETER and technic
- ☐ SLIDES: Walraven ARC Treatment series
- ☐ SLIDES: Orthoptic Award Series 44 Slides
- ☐ SLIDES: George Washington Diagnostic Series
- ☐ SLIDES: Accommodative Convergent Squint

ORTHOPTIC TRAINING

means comfortable and happy patients

BOOTHS 23 and 24

A Complete Display of
ORTHOPTIC SPECIALTIES and Other Instruments

THE *Wottring* . . .
INSTRUMENT COMPANY
HUNTINGTON BANK BLDG. COLUMBUS 15, OHIO

From Clement Clarke

OF LONDON, ENGLAND

★ **THE LYLE MAJOR AMBLYOSCOPE**

STANDARD INSTRUMENT INCLUDING TRANSFORMER

F.O.B. London $211.31
C.I.F. New York $228.8

INSTRUMENT COMPLETE WITH MIRROR OSCILLATION AND AUTOMATIC FLASHING DEVICES.

F.O.B. London $337.12
C.I.F. New York $356.2

CLEMENT CLARKE

16, WIGMORE STREET, LONDON, W.1., ENGLAND

Cablegrams: Clemclarke, London. Telephone: Langham 2242

IN ASSOCIATION WITH ALLIED INSTRUMENT MANUFACTURERS LTD., OF LONDON

★ *Some of the instruments in the Clement Clarke range:*

NEW PROJECTION PERIMETER
NEW PATTERN SLIT LAMP
PRACTITIONER'S CHEIROSCOPE AND HOME MODEL CHEIROSCOPE
VARIABLE PRISM STEREOSCOPE
NEW MADDOX HANDFRAME
MADDOX WING TEST
REMY SEPARATOR
PIGEON CANTONNET STEREOSCOPE
WORTH 4-DOT TEST
DUOCHROME LETTER TEST
FOVEOSCOPE
AIMARK OPHTHALMOSCOPE
ISHIHARA COLOUR TEST
NEW HAND OPERATING LAMP

GUILD Rx OPTICIANS

The Keeler SENIOR WIDE-ANGLE OPHTHALMOSCOPE

THIS popular and well established ophthalmoscope is ideal for the ophthalmic surgeon. It embodies the following noteworthy features:

- **Wide angle of view.**
- **Brilliant illumination with variable control.**
- **Corneal reflex reduced to a minimum.**
- **Finger-tip control focussing device.**
- **Pinhole disk for detailed macular examination.**
- **Red-free filter.**
- **Anti-glare hood to exclude extraneous reflection.**
- **Wide range of viewing lenses, i.e., plus 32 and minus 50 dioptres.**
- **Magnified and illuminated indicator for lens power.**
- **Pre-centered bulb which eliminates all mechanical adjustment.**
- **Robust construction.**
- **Durable finish.**
- **Convenient interchangeability of components.**

The illustrations show the Keeler Senior Wide Angle Ophthalmoscope on battery handle to the left, and on mains cord handle fitted with dimming switch to the right.

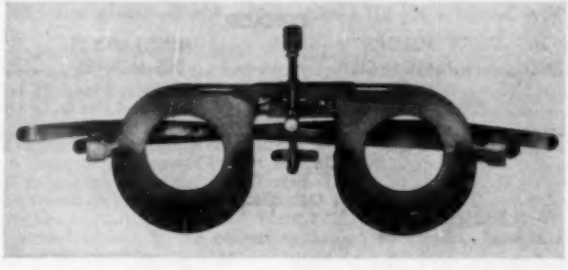
Full details of these and other instruments of the Keeler range may be obtained by direct application to the U.S. Sales Office now established at the undermentioned address:

No. 617, SOUTH FIFTY-SECOND STREET
PHILADELPHIA 43, PA.

E. B. Meyrowitz

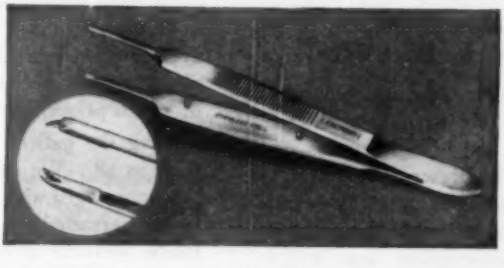
SURGICAL INSTRUMENTS CO., INC.,
520 FIFTH AVENUE, NEW YORK 18, N. Y.
LONDON ESTABLISHED 1875 PARIS

GRIFFITH-ROGERS TRIAL FRAME



This trial frame is a simple but sturdy and easily adjustable frame that is designed for rapid routine examinations over a long period of time. It will stand hard usage. Interpupillary distance is adjustable by means of a rack and pinion and the bridge height is adjusted by the same knob. Bridge may be locked. Temples are of spring steel to support the frames in position. Protractor is black with white letters and there are two front and one rear pairs of slots for the trial lenses. In stainless steel. **Price $25.00**

CASTROVIEJO UTILITY FORCEPS



This utility forceps is made with two-sized teeth. The one with the larger teeth is used for fixation, corneal cateract surgery and scleral work while the one with the smaller teeth is used for fine corneal work exclusively. The small blocks to the rear of the teeth are most useful to manipulate the needle and thread when tying.

Stainless Steel $ 8.50

De Luxe model $11.50

A SCIENTIFIC CORNER

WHERE OPTICAL PROBLEMS ARE DISCUSSED AND
THE SOLUTIONS, AS SOLVED BY EXPERIENCE, INDICATED

PRESENTED BY

THE HOUSE OF VISION

BELGARD-SPERO, INC.

CHICAGO

MILWAUKEE AURORA MINNEAPOLIS MUSKEGON
HIGHLAND PARK MASON CITY DES MOINES OAK PARK
EVANSTON

FALSE PHORIAS

A cataract case shows very clearly how prisms may be prescribed for a phoria that does not exist but is caused by a facial or pupillary asymmetry.

Mr. X had been to us before with a cataract prescription. In taking his measurements we found the left pupil 1½ mm. higher than the right pupil.

When we ground the lenses for Mr. X we ground the left optical center 1½ mm. higher than the right center and the results were entirely satisfactory.

Recently Mr. X decided it was time for a re-examination. He went to a different ophthalmologist and brought us his new prescription. The prescription was very similar to the previous one with several small changes calculated to improve his acuity. The prescription was R.E.+12.50+1.00×175, L.E.+12.50+2.00×160, with +2.25 added to each eye. In addition to the above prescription the doctor had prescribed 1 degree of prism base down in the right eye and one degree of prism base up in the left eye.

We ground Mr. X a new pair of glasses agreeable to the new prescription and as before ground the left optical center 1½ mm. higher than the right to care for the asymmetry. The patient was back in a few days complaining bitterly about a strain on his eyes.

It took us a little time to realize that the phoria for which the doctor had prescribed did not exist but was caused by the one pupil being higher than the other. Mathematically it worked out perfectly One eye being 1½ mm. above the other would almost exactly account for the 2 degrees of prism prescribed for his false phoria.

Making the patient comfortable was no trick at all. We checked with Mr. X's ophthalmologist who readily saw that since he had refracted the patient with the trial frame perfectly straight on the patient's face and not tilted to care for the higher eye, he had corrected a phoria that did not exist.

A new pair of lenses ground for Mr. X without the prisms but with proper decentration made him perfectly comfortable.

"IF IT'S A LENS PROBLEM, LET'S LOOK AT IT TOGETHER"

AMERICAN JOURNAL OF OPHTHALMOLOGY

SERIES 3 · VOLUME 33 · NUMBER 9 · SEPTEMBER, 1950

CONTENTS

ORIGINAL ARTICLES

Clinical and experimental observation on the use of ACTH and Cortisone in ocular inflammatory disease. Alan C. Woods 1325
Chemistry of pituitary principles acting upon ocular tension. Albert A. Dietz, Ernst Schmerl, and Bernhard Steinberg 1349
Glaucoma: A statistical review of 816 patients with 1,112 glaucomatous eyes. Albert N. Lemoine, Jr. 1353
The problem of glaucoma. Herman Elwyn 1373
Separation of diencephalic centers concerned with pupillary motility and ocular tension. Ernst Schmerl and Bernhard Steinberg 1379
Glaucoma: Some social and medical aspects. Daniel Kravitz 1381
Trephining operations. J. Alexander Van Heuven 1387
The visual field as an aid to prognosis in glaucoma. Adolph Posner and Abraham Schlossman 1391
Iridoschisis as a cause of glaucoma. Clement McCulloch 1398
Nevus flammeus associated with glaucoma. Harold H. Joy 1401
Lysozyme in the treatment of ophthalmic conditions. Carl Hobart 1409
Peripheral choroiditis simulating retrolental fibroplasia. R. D. Harley and R. W. Mather .. 1417
Retardation of wound healing in the corneal epithelium by lanolin. Johanna C. Heerema and Jonas S. Friedenwald 1421

NOTES, CASES, INSTRUMENTS

Visual-field testing: Suggestions on technique. Louise H. Darley 1428
Clinical observations of the effect of tobacco on the angioscotoma in glaucoma. Marion Macdonald Castagno 1431
Adenocarcinoma of the meibomian gland. Marion L. Rice and Harold I. Lindeke 1434
The use of milk-procaine in foreign-protein therapy. John A. Cetner 1437
Visual disturbances due to the use of digitalis and similar preparations. Joseph V. M. Ross 1438
Corrugated silver wire for severing pterygium from the cornea. Paul Tower 1439
Evaluation of recent provocative tests for preglaucoma. Paul Weinstein 1442
Ferris-wheel attachments for Brewster-type stereoscope. Emanuel Krimsky 1444

SOCIETY PROCEEDINGS

Nashville Academy of Ophthalmology and Otolaryngology, March 20, 1950 1446
College of Physicians of Philadelphia, Section on Ophthalmology, October 20, 1949 1447
Colorado Ophthalmological Society, September 17, 1949 1453

EDITORIAL

Income-tax deductions for kickbacks 1456

CORRESPONDENCE

Destruction of the macula by indirect violence 1458

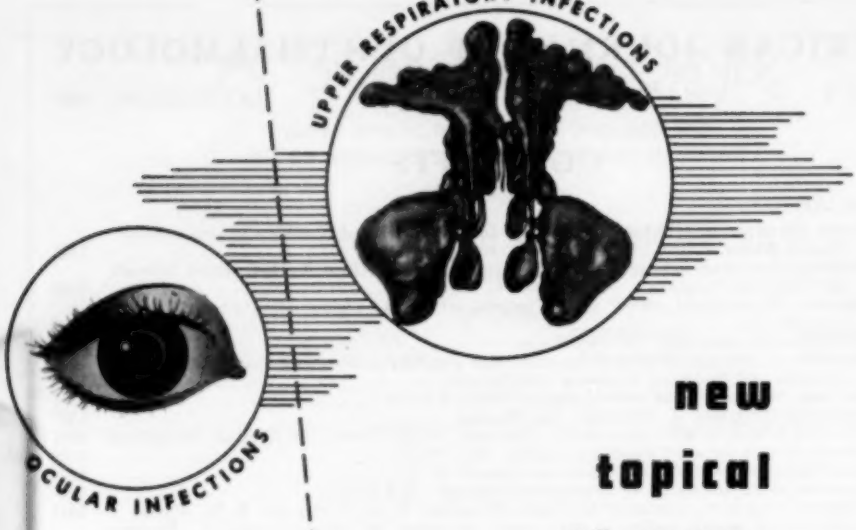
BOOK REVIEWS

Proceedings of the First Clinical ACTH Conference 1460
Clinical Orthoptic Procedure 1460
Diseases of the Eye, Ear, Nose, and Throat 1462
Bulletin of the Belgian Society of Ophthalmology 1462

ABSTRACTS

Conjunctiva, cornea, sclera; Uvea, sympathetic disease, aqueous; Glaucoma and ocular tension; Crystalline lens; Retina and vitreous; Optic nerve and chiasm; Neuro-ophthalmology; Eyeball, orbit, sinuses; Eyelids, lacrimal apparatus; Tumors; Injuries; Systemic disease and parasites; Congenital deformities, heredity; Hygiene, sociology, education, and history 1464

NEWS ITEMS 1495



new topical therapy

SULFAMYLON — 4-aminomethylbenzene-sulfonamide, a new sulfonamide compound which is not inhibited by para-aminobenzoic acid — effectively controls upper respiratory, ocular and wound infections. Sulfamylon is bactericidal for a wide range of gram negative and gram positive bacteria including anaerobes (gas gangrene). Applied topically by swab, instillation, irrigation, atomizer or wet dressings.

Sulfamylon hydrochloride available in 1 per cent solution, bottles of 1 fl. oz. and 8 fl. oz. Also in *combination* of 100 cc. vials of 5 per cent solution with vial of *Streptomycin* sulfate 20,000 units.

Sulfamylon®

EFFECTIVE TOPICAL ANTIBACTERIAL

Winthrop-Stearns INC.
NEW YORK, N. Y. WINDSOR, ONT.

Attend the American Academy of Ophthalmology and Otolaryngology Annual Meeting. Chicago, Illinois. October 8-13. Visit our Exhibit R-7.

Sulfamylon, trademark reg. U. S. & Canada

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 33 SEPTEMBER, 1950 NUMBER 9

CLINICAL AND EXPERIMENTAL OBSERVATION ON THE USE OF ACTH AND CORTISONE IN OCULAR INFLAMMATORY DISEASE*

ALAN C. WOODS, M.D.
Baltimore, Maryland

In 1949 Hench, Kendall, Slocomb, and Polley[1] reported from the Mayo Clinic that a hormone of the adrenal cortex (the 17 hydroxy-11 dehydrocorticosterone or Compound E) and the pituitary adrenotrophic hormone (ACTH) had a dramatic though temporary therapeutic effect on rheumatoid arthritis. This discovery has led to a widespread exploratory use of these compounds in a variety of disease conditions and a considerable body of information has now been accumulated.[2] It has been shown that there is a marked improvement in rheumatoid arthritis and acute rheumatic fever after the use of these compounds,[2, 3, 4] and that they have likewise an effect in collagen disease such as lupus erythematosis.[5, 3] All authors, however, stress that symptoms are prone to recur shortly after cessation of therapy and that the side effects may be severe.

More recently Sprague and his associates[5] have shown the remarkable action of these agents in controlling the symptomatology of various allergic diseases, notably asthma, allergic rhinitis, and so forth. It is the purpose of this paper to review briefly the physiologic action of these hormones, the precautions and contraindications for their use, the present ideas of dosage and administration, and to report observations of their effect in certain clinical ocular diseases and experimental ocular inflammations.

Within the last decade significant advances have been made in our knowledge of the action of the hormones of the adrenal cortex. This information on the physiologic action of these compounds has recently been summarized in comprehensive reports.[5, 6, 7] It has been shown that these hormones have widespread metabolic effects and produce profound alterations in body function. In its simplest form, the over-all effects fall into three general groups:

1. An electrolyte regulating effect, produced by the so-called "salt" hormones, of which 11-desoxycorticosterone appears the most potent. The 11-17 oxysteroids (Compounds E and F) have only a relatively weak sodium retaining effect. The most important of the metabolic changes in this group are a retention of sodium chloride, an increased excretion of potassium, and an increase in plasma and extracellular fluid volume.

2. The regulation of the carbohydrate, protein, and fat utilization, and control of the lymphoid tissue and circulating eosinophils. The hormones with these effects are called "S" hormones and the most active ones producing these effects are 17-hydroxy-11-dehydrocorticosterone (Compound E—

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University. Presented at the 86th annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1950. The cases treated with ACTH were studied and treated in coöperation with the Department of Medicine. The ACTH used in these patients and experimental animals was supplied by Armour and Company through the courtesy of Dr. John R. Mote. The cortisone used was purchased with a grant from the Public Health Service, National Institute of Health.

Cortisone) and 17 hydroxycorticosterone (Compound F). The most evident metabolic changes in this group are an increase in the glucose level and the glycogen stores, an increased conversion of protein to carbohydrate (glucogenesis), and increased mobilization of fat and its enhanced utilization, an increase in the renal clearance of uric acid, a lysis of fixed lymphoid tissue, and a depression of the circulating eosinophils almost to disappearance.

3. An androgenic effect, produced chiefly by the so-called "N" hormones which are believed to exert an effect similar to that of testicular androgens—masculinization, retention of nitrogen, phosphorus, potassium, sodium, and chloride. They are related in structure to testosterone. An excess production of these steroids causes an increased excretion of the 17-ketosteroids.

The pituitary gland secretes, among other hormones, the adreno-cortico-trophic hormone or ACTH. The pituitary gland can be stimulated to the production of this hormone from a hypothalamic source, and through the hypothalamus by epinephrine, which is secreted by the adrenal medulla, illustrating the reciprocal action of adrenals and pituitary. Thorn and others have shown that, when ACTH is injected parenterally, the normal adrenal cortex responds with a production of all the various adreno-cortico-hormones and their increased action can be demonstrated by metabolic studies. While exogenous ACTH stimulates the adrenal cortex, it also suppresses the normal pituitary ACTH mechanism. However, when ACTH therapy is terminated, there is usually a rapid return of the normal adrenal cortex function.

Cortisone, on the other hand, is believed to suppress both the pituitary and the adrenal cortex function, even to the point that the glands may become atrophic. Thus with the withdrawal of cortisone therapy there is usually an adrenal cortical deficiency which is much more sustained and marked than is the temporary deficiency evoked by exogenous ACTH. Thus, it is apparent that ACTH can act only when a relatively normal adrenal cortex can respond to the stimulation, while the cortisone can exert its effect with an atrophic adrenal cortex as in Addison's disease.

The prolonged administration of ACTH or cortisone may result in untoward physiologic effects. Most important of those is Cushing's syndrome, with the clinical picture of muscle weakness, abnormal distribution of fat with the characteristic facies, hirsutism, hypertension, and amenorrhea. This syndrome was first described by Cushing in 1932 in basophilic tumors of the pituitary gland and is probably related to adrenal cortex hypertrophy.

Precautions and contraindications for clinical use

When these agents are administered clinically, one of the most immediate subjective changes is the disappearance of pain which appears to herald a reversal in the disease process. Likewise, if the patient was febrile prior to the administration of ACTH or cortisone, there is usually a prompt return of the temperature to normal. The reappearance of pain or fever during the treatment period is an indication for the cessation of treatment until the cause of the recurrence can be evaluated.

Since these hormones may cause a marked change in the electrolyte balance and fluid retention, vascular hypertension and chronic nephritis are contraindications for their use. Similarly, since they have a profound effect on the carbohydrate metabolism, they are contraindicated in patients with a concomitant diabetes. Further, since they produce a substantial alteration in cerebral function, their use in psychotic patients should be guarded.

In general patients under treatment with ACTH or cortisone should have a low sodium-chloride intake. In higher dosages, the fluid balance should be followed. It has been advised that, since these agents

cause a marked increase in potassium excretion, they should be accompanied by a high potassium intake.

Dosage

There may be considerable variation in the response of different individuals to ACTH and cortisone, depending respectively on the varying sensitivity of the adrenal cortex to stimulation, and to the depressant action of cortisone. The most sensitive objective clue to the adrenal cortex stimulation and to the action of cortisone is the eosinophil count in the peripheral blood. Normally, this is in the neighborhood of 200 cells per cubic millimeter. Under proper stimulation of the adrenal cortex by ACTH or by the parenteral injection of cortisone, it may be decreased from 50 percent to a complete disappearance of the eosinophils. The eosinophil count is the most satisfactory "rough and ready" index of a proper response. The uric and creatin ratio and the urinary excretion of the 17 ketosteroids are also indices of adrenal cortical stimulation but are of little practical value in assessing adequate dosage.

The optimum dosage of both ACTH and cortisone is as yet undetermined. It is likewise unknown how long treatment should be continued to obtain the maximum results. It is possible that smaller doses than those outlined below will prove efficacious as more experience is accumulated. At present one must carefully follow the progress of the disease and the evidences of adrenal stimulation in each individual as there may be a wide range of dosage necessary from patient to patient. Once beneficial results are obtained, the improvement can usually be maintained with smaller doses. There appears to be a relationship between the effect on circulating eosinophils and the clinical results. If the dose of ACTH is too rapidly reduced eosinophils reappear and symptoms may immediately recur.

In general ACTH was given the first 3 to 4 days in doses of 80 to 100 mgm. (Armour) per diem, in divided doses (one fourth every six hours). Thereafter, the dose was tapered to 80, 60, 40, and finally to 20 mgm. per diem. Infants were given proportionately smaller doses. The minimum period of treatment with ACTH was 10 days in a patient with sympathetic ophthalmia in whom a brilliant result was obtained, up to a maximum of 47 and 49 days in two patients with, respectively, disciform degeneration and sympathetic ophthalmia. The average period of treatment with ACTH was 24 days.

Cortisone was given in the dosage suggested in the February, 1950, brochure of Merck and Company—300 mgm. for the first day, 200 mgm. on the second day, and thereafter 100 mgm. per diem for a period of 7 to 14 days. No untoward side effects were noted in any of the patients treated with the above dosages.

Local treatment

In hospital patients one drop of undiluted cortisone suspension, 1.0 cc./25 mgm., was instilled in the eye every hour during the day and every two hours during the night. This caused mild transient irritation which passed in a few minutes. In ambulant patients the instillation was every hour throughout the day and irregularly during the night. In two patients it was necessary to dilute the 1.0 cc./25 mgm. 1:4 on account of local irritation.

Ancillary studies

All patients who received systemic treatment had daily total eosinophil counts by the Thorn and Forsham technique. In several patients with a demonstrable hypersensitivity to either tuberculin, bacterial antigens, or drugs the cutaneous reactions to the specific allergen were determined before and after treatment.

ACTH and Cortisone in ocular disease

There is only occasional mention of the effect of these hormones on ocular inflam-

mations. Elkinton[9] reports the complete clearing of a hemorrhagic retinopathy in a case of generalized collagen disease treated with ACTH; Mann and Markson[9] report a case of iritis and episcleritis which cleared completely on ACTH therapy. Olson[10] and his associates report seven cases of inflammatory ocular disease treated with ACTH in total dosages of 182 to 432 mgm., with a marked control of the inflammatory symptoms.

Gordon and McLean[11] report six cases of various forms of ocular disease treated with ACTH in total dosages of from 75 to 525 mgm. In the inflammatory cases there was a dramatic response. In a later communication, McLean[12] reported that his further experiences in a total of about 40 cases confirmed his preliminary observations—in inflammatory ocular disease, there was a remarkable control of the exudation and inflammation and this improvement occurred synchronously with a fall in the circulating eosinophils.

Jones and Meyer[13] have reported an experimental study in which they showed that the subconjunctival use of cortisone inhibits the vascularization of the cornea which follows alkali burns, indicating a peripheral and local action of cortisone (Compound E). Except for these isolated observations, the ophthalmic literature is as yet almost barren of reports on the clinical use of these hormones.

Use of ACTH and Cortisone on clinical ocular disease

In August, 1949, Dr. A. McGehee Harvey, at the instigation of Dr. William Marr, treated a case of nongranulomatous iritis associated with an early rheumatoid arthritis with ACTH (Case 1). The immediate results in this case were so dramatic that, as further supplies of ACTH and cortisone became available, other patients with various forms of ocular disease on the ophthalmologic and medical wards of the hospital have been treated. The purpose of this paper is to report the results in these cases and certain experiments in animals which were stimulated by the clinical observations. I am indebted to Dr. William Marr, Dr. Angus McLean, and Dr. William C. Owens for their permission to include their private patients.

ACTH and cortisone have been administered parenterally in the treatment of 14 patients with various ocular disorders. Cortisone has been used topically in the eye in the treatment of eight additional patients.

Parenteral administration of ACTH and Cortisone

The cases treated parenterally fall into two groups: those which showed no change in the eyes after such treatment, and those which showed a marked, often dramatic effect.

The five cases in the first group are shown in Table 1. One was a case of advanced, syphilitic interstitial keratitis with necrosis and ectasia of the cornea. This patient had been previously treated with subconjunctival penicillin, and the active stage of inflammation had been controlled. The second was a case of Cogan's syndrome (nonsyphilitic interstitial keratitis with vertigo and deafness); the third a case of unilateral advanced juvenile Coats's disease, and the last two cases were retrolental fibroplasia.

The treatment of two cases of keratitis was entirely exploratory. There was little evidence of active inflammation but the exact pathogenesis of the disease was undetermined, and there was a possibility of an allergic background. Treatment with ACTH and cortisone was therefore justified.

The reason underlying the treatment of the Coats's disease and the retrolental fibroplasia patients was that a remarkable subsidence of subretinal edema has been noted in several cases of central serous retinopathy and it seemed reasonable to explore the possibility of such absorption in retrolental fibroplasia. No effects of any kind directly attributable to the ACTH or cortisone were

TABLE 1

SYSTEMIC TREATMENT WITH ACTH AND CORTISONE*
(Unimproved)

No.	Diagnosis	Treatment	Result
507475	Syphilitic interstitial keratitis	ACTH	No improvement (patient with corneal necrosis treated in noninflammatory stage)
527767	Juvenile Coats's disease	ACTH	No improvement
532320	Cogan's syndrome (nonsyphilitic keratitis with audiovestibular involvement)	Cortisone	No improvement
A74384	Retrolental fibroplasia	ACTH	No improvement
A75782	Retrolental fibroplasia	ACTH	Some subsidence in subretinal edema. Progression of gliosis

* Encouraging results have been observed in one case of advanced sympathetic ophthalmia treated locally with cortisone.

TABLE 2

SYSTEMIC TREATMENT WITH ACTH AND CORTISONE
(Improved)

No.	Diagnosis	Treatment	Result
511411	Nongranulomatous iritis, recurrence after 7 months	ACTH Cortisone	Prompt recovery. Recurrence in 7 months. Prompt recovery
507475	Disciform degeneration of macula secondary to subretinal hemorrhage (bilateral). Central, serous retinopathy, R.E.	ACTH	Improvement in vision, R.E., from 20/70 to 20/30. Decrease in paracentral scotomas
523479	Sympathetic ophthalmia, atropine sensitivity	ACTH	Clearing of all inflammation. R.E., vision rose from 4/200 to 20/30. Blocking of atropine sensitivity
525991	Sympathetic ophthalmia	ACTH	Clearing of all inflammation. Vision rose from 20/50 to 20/15
532752	Tuberculous(?) sclerokeratitis, atropine sensitivity	ACTH	Clearing of all ocular inflammation. Blocking of atropine sensitivity
533134	Tuberculous choriditis, secondary glaucoma	Cortisone	Clearing of vitreous—subsidence of subretinal edema. Control of secondary glaucoma
534114	Nongranulomatous cyclitis, central serous retinopathy (bilateral)	Cortisone	Subsidence of subretinal edema in 4 days. Vision in each eye rose from 20/70 to 20/30
534258	Tuberculous uveitis, secondary glaucoma	Cortisone	Clearing of the vitreous and increase in vision in 4 days. Immediate relapse after cessation of treatment. Very slight change in eosinophil count
262085	Tuberculous uveitis, secondary glaucoma	ACTH	Complete clearing of all external inflammation. Vision rose from fingers to 20/100. Control of secondary glaucoma

observed in any of these five cases, although in one case of retrolental fibroplasia there appeared to be a decrease in the subretinal edema accompanied, however, by an increase in the gliosis.[14]

The cases in the second group are shown

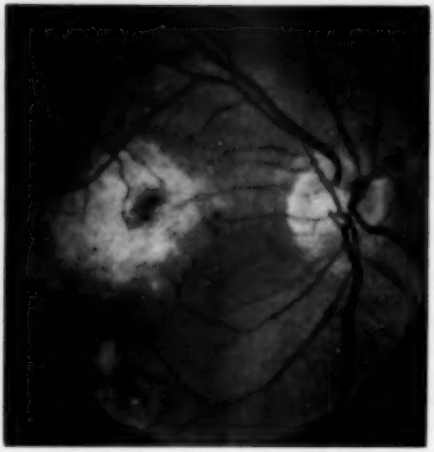


Fig. 1 (Woods). Fundus of the right eye in Case 2 before treatment.

in Table 2. They include one case of nongranulomatous iritis, one case of bilateral disciform degeneration of the macula, two cases of sympathetic ophthalmia, three cases of probable tuberculous uveitis, one case of probable tuberculous kerato-iritis with marked atropine sensitivity, and one case of recurrent nongranulomatous cyclitis with central serous retinopathy. The results observed in these nine cases were so instructive that brief mention of each case should be made.

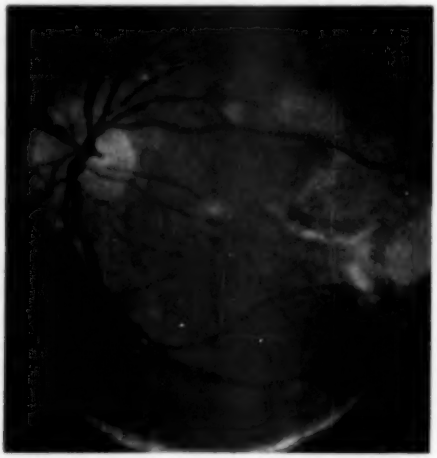


Fig. 2 (Woods). Fundus of the left eye in Case 2 before treatment.

CASE 1 (511441)

Recurrent unilateral nongranulomatous iritis associated with rheumatoid arthritis. The patient was first seen in an attack of three weeks' duration and vision was reduced to 20/70. General symptomatic treatment, including nonspecific protein therapy, had been unavailing. Treatment with ACTH was followed by prompt relief of inflammation 12 hours after starting treatment. Vision rose to 20/30 within five days and to 20/20 within two weeks. The total dosage of ACTH was 514 mgm. There was a complete remission for seven months when the iritis recurred. Examination at this time

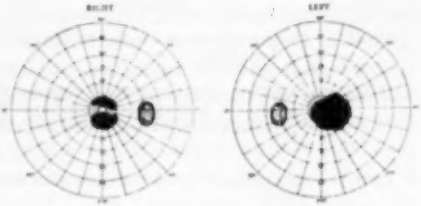


Fig. 3. (Woods). Visual fields in Case 2 before treatment.

showed marked cutaneous hypersensitivity to four strains of the subgroup A of the Beta streptococci. The patient was then put on cortisone therapy. After five days of treatment, corresponding with a fall in the circulating eosinophils, all evidence of inflammation in the eye disappeared and vision advanced to 20/15.

CASE 2 (507475)

Disciform degeneration of the macula secondary to macular hemorrhage eight years previously in right eye and two years previously in left eye. On admission the right eye showed subretinal edema in the macular area with retinal atrophy. The left eye showed a similar picture with an overgrowth

of glial tissue and yellowish crystals over the lesion (figs. 1 and 2). Visual fields showed absolute scotomas above and below the point of fixation in the right eye and a large central scotoma in the left eye (fig. 3). Vision on admission was: R.E., 20/70; L.E., 20/200. After 47 days' treatment with ACTH, the subretinal edema in the right eye subsided and vision rose to 20/30. In the left eye, the subretinal edema subsided and

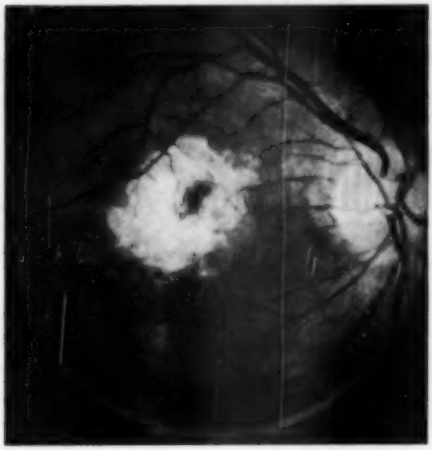


Fig. 4 (Woods). Fundus of the right eye in Case 2 after treatment.

the yellowish crystals below the lesion disappeared. Vision remained at 20/200. Figures 4 and 5 show the right and left eyes at the end of treatment. The visual fields in the right eye showed a disappearance of the upper scotoma; in the left eye the central scotoma decreased in size (fig. 6). The total dosage of ACTH was 2,228 mgm. over a 47-day period.

CASE 3 (523479)

Sympathetic ophthalmia. This case was of a 66-year-old woman with a full-blown sympathetic ophthalmia of one week's duration following a cataract extraction in the right eye seven weeks previously. On admission corrected vision was 4/100 in the right eye

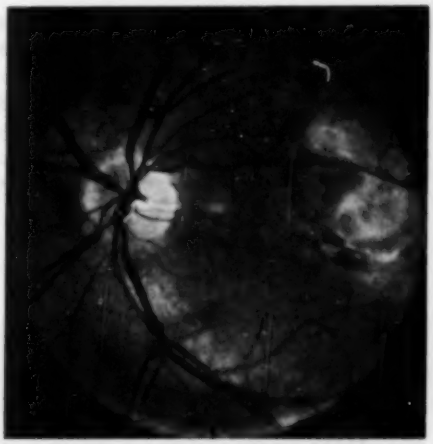


Fig. 5 (Woods). Fundus of the left eye in Case 2 after treatment.

and the vitreous was so cloudy the fundus could not be visualized. Corrected vision in the left eye was 20/200. There was a dense nuclear cataract in the left eye.

An atropine sensitivity had developed four days prior to admission and atropine had been discontinued. There was an immediate favorable response to ACTH therapy with a clearing of the vitreous in the right eye and a subsidence of inflammation. After five days' treatment, atropine was again given and was tolerated without reaction for nine days. After 10 days' treatment corrected vision was: R.E., 20/50; L.E., 20/200. When the dose of ACTH was reduced to 10 mgm. per diem, there was a recurrence both of ocular inflammation and

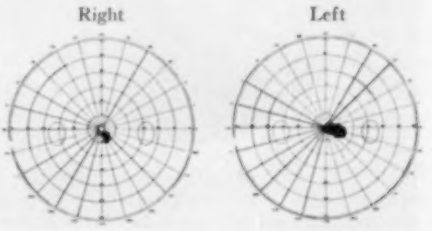


Fig. 6 (Woods). Visual fields in Case 2 after treatment.

the atropine sensitivity. With an increase in the dosage of ACTH the inflammation again subsided.

After 42 days of treatment the supply of ACTH temporarily gave out and the patient was five days without treatment. There was a second exacerbation of the inflammation synchronous with this. With a resumption of the ACTH, the inflammation again subsided. The dosage of ACTH was then gradually reduced and, after seven days' further treatment, was discontinued. There was again a subsidence of the inflammatory reaction which did not return with termination of treatment.

At discharge corrected vision was: R.E., 20/30; L.E., 20/100. This has been maintained to date over a five months' period. Figure 7 shows graphically the relation of treatment to inflammation and vision in the right eye. Figures 8 and 9 show the external appearance of the right and left eyes on admission and Figures 10 and 11 show the appearance of the eyes on discharge. The total dosage of ACTH was 3,240 mgm. over a 49-day period.

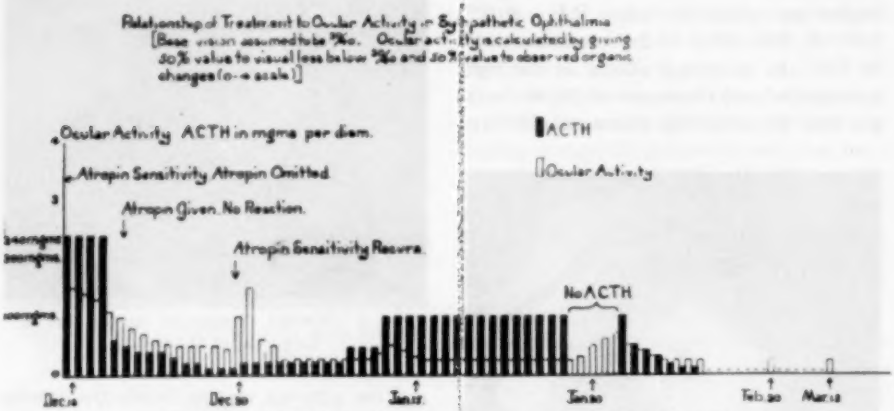

Relationship of Treatment to Ocular Activity in Sympathetic Ophthalmia
[Base vision assumed to be 20/20. Ocular activity is calculated by giving 50% value to visual loss below 20/20 and 50% value to observed organic changes (0–4 scale)]
Ocular Activity ACTH in mgms per diem.
Atropin Sensitivity Atropin Omitted
Atropin Given. No Reaction.
Atropin Sensitivity Recurs.
No ACTH
ACTH
Ocular Activity
Dec 16
Dec 30
Jan 13
Jan 30
Feb 20
Mar 16

Fig. 7 (Woods). Relationship of treatment to ocular activity (Case 3).

Fig. 8 (Woods). The right (exciting) eye in Case 3 before treatment.

Fig. 9 (Woods). Left (sympathizing) eye in Case 3 before treatment.

CASE 4 (525991)

*Sympathetic ophthalmia.** A 62-year-old woman had sympathetic ophthalmia of the left eye following an iridencleisis of the right eye four weeks previously. On admission, vision was: R.E., hand movements; L.E., 20/50. There was an immediate favorable response to ACTH therapy, the inflammation steadily subsided in both eyes and vision improved, and, at the end of 10 days

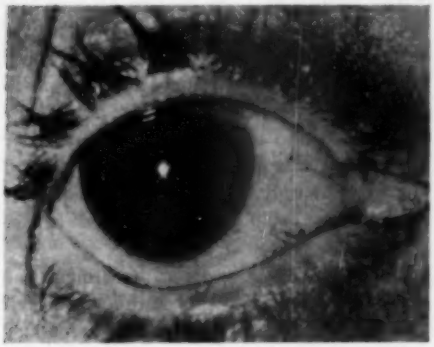


Fig. 10 (Woods). Right (exciting) eye in Case 3 after treatment.

of treatment, vision was: R.E., 8/200; L.E., 20/30. After discharge the improvement continued and four months later vision was: R.E., 8/200; L.E., 20/15.†

CASE 5 (532752)

Tuberculous kerato-uveitis and atropine sensitivity. A 42-year-old woman had a recurrent tuberculous kerato-uveitis, the present attack being of five months' duration, complicated by violent dermatitis due to atropine sensitivity. On admission the eye was violently inflamed, with edema of the corneal epithelium and elevated tension. Vision was limited to light perception. No accurate examination was possible because of the induration and edema of the lids. The patient was violently sensitive to tuberculin and to two strains of streptococci and gave a marked reaction to the atropine patch test.

There was an immediate favorable response to ACTH therapy. The atropine dermatitis rapidly cleared, the induration of

Fig. 11 (Woods). Left (sympathizing) eye in Case 3 after treatment.

the lids subsided, the examination of the eye, which was now possible, showed residual pericorneal congestion and a corneal infiltrate.

After one week of treatment the patient was challenged with atropine to which she now showed only a minimal reaction on a patch test. She was likewise challenged to tuberculin and now showed a 10 by 10 erythema to 0.01 mgm. of tuberculin, to which she had before showed a violent erythema, induration, and necrosis. She showed no reaction to the strains of streptococci to which she had formerly been sensitive.

On discharge after 16 days' treatment, all trace of dermatitis has disappeared, the eye was entirely white and free of inflammation, and vision had risen to 20/100. There was some capsular clouding of the lens. The

* The ACTH used in this case was supplied by G. S. Searle and Company through the courtesy of Dr. Ira Winters.

† Five months after the patient was discharged from the hospital, she had a sudden attack of acute glaucoma in the left eye. There were, however, no associated evidences of a sympathetic inflammation or uveitis.

total dosage was 1,360 mgm. over a 16-day period. One month later the eye was still entirely free of inflammation and vision had risen to 20/50.

CASE 6 (533134)

Tuberculous choroiditis and secondary glaucoma. A 17-year-old boy had a unilateral tuberculous choroiditis of four months' duration with some involvement of the anterior uvea. On admission vision was 3/200, and the media were so cloudy no fundus details could be visualized. There was a whitish reflex above. Tension varied between 35 and 40 mm. Hg (Schiøtz).

Cortisone therapy was followed by a marked clearing of the vitreous and a gradual fall of tension to normal. After completion of the course of cortisone therapy over 10 days, the outlines of the disc could be seen. A large circumscribed exudate was visible in the upper fundus and the macula showed evidence of degeneration. Vision had risen to 15/200. The patient was discharged to his physician for streptomycin and promizole therapy. The total dosage of cortisone was 1,280 mgm. over a 10-day period.

CASE 7 (534114)

Nongranulomatous iridocyclitis with central serous retinopathy. A woman aged 52 years, with a history of rheumatoid arthritis over 18 years had had recurrent attacks of bilateral iridocyclitis with central serous retinopathy over one year. On admission, the arthritis was inactive with minimal crippling residua. The eyes were free of inflammation but vision was reduced to 20/70 in each eye, and ophthalmoscopic examination showed an elevation of about two diopters in each macula with a blurred reflex. There were bilateral paracentral scotomas.

Cortisone was given in the usual dosage over a 10-day period. There was an almost complete subsidence of the macular edema and corrected vision rose to: R.E., 20/30+4; L.E., 20/30. The central scotoma disappeared to the extent that only small multiple relative scotomas could be detected with a one-sixth degree target.

CASE 8 (534258)

Chorioretinitis (tuberculous?). A 21-year-old white woman gave evidence of an old, inactive, pulmonary tuberculosis. The right eye was blind from an old uveitis and secondary detachment of the retina. The left eye had become violently inflamed two days before admission.

On admission the left eye showed an active, generalized uveitis with vision reduced to 20/50. The medical survey was negative except for evidences of an old pulmonary tuberculosis and tuberculin hypersensitivity. The patient was placed on streptomycin and promizole therapy, from which the first beneficial effects could not be expected before two weeks' treatment.

During the first week of treatment the vitreous continued to cloud, the vision fell to 5/200 and the eye went into secondary glaucoma with a tension around 50 mm. Hg (Schiøtz). Cortisone was then given intramuscularly. It had only a moderate depressant effect on the circulating eosinophils. After three days of treatment, the eye improved somewhat. The tension fell to normal and vision improved to 20/70. After 11 days of treatment, cortisone was discontinued. During the period of treatment, it continued to have only slight effect on the circulating eosinophils.

Immediately on discontinuing the cortisone the eye became inflamed. Vision fell and tension rose to 40 to 50 mm. Hg. Cortisone was then given topically over an eight-day period, during which time all of the external inflammation disappeared. The tension dropped to normal but there was no change in the vitreous clouding.

The patient was now given a second course of intramuscular cortisone but again with no effect on the circulating eosinophils and with no resulting clearing of the vitreous. The eye remained white and free of inflam-

mation with normal tension. At the end of the fourth week, the eye began to improve and the vitreous to clear—an effect believed due to the streptomycin and promizole.

CASE 9 (262058)

A 27-year-old Negress had a history of recurrent enlargement of the parotid gland over eight years with an epitrochlear, axillary and hilar adenopathy. Biopsy of the glands had been variously reported as sarcoid and later as caseous tuberculosis. The right eye had a uveitis of one year's duration with secondary glaucoma. Before treatment the right eye showed violent pericorneal congestion, heavy mutton-fat keratic deposits, and a positive aqueous ray, with a thickened edematous iris without nodules. There were heavy clouds in the vitreous. The tension varied between 19 and 40 mm. Hg (Schiøtz). Vision was hand movements.

After six days' treatment with ACTH, all ciliary congestion faded and the aqueous ray became negative. Tension remained elevated for 10 days and then fell to normal. Vision rose to 20/100. There was some clearing of the vitreous.

TOPICAL USE OF CORTISONE*

Inasmuch as cortisone appears to be the most potent of the hormones produced through stimulation of the adrenal cortex by ACTH, and the parenteral injection of exogenous cortisone produces an effect quite similar to that produced by ACTH, the question immediately arises if cortisone instilled locally in the eye would have any effect on ocular inflammation or overgrowth of lymphoid tissue.

The local use of cortisone would have immense advantages, if any such peripheral therapeutic action could be demonstrated. These advantages are: (1) That much smaller amounts of the hormone would be required; (2) that the depressant action of exogenous cortisone on the adrenal cortex might be avoided, (3) any effect obtained by local treatment might be more permanent, since the normal secretion of cortisone by the adrenal cortex might not be seriously interfered with by the instillation of small amounts of exogenous cortisone. That cortisone locally might have an effect on ocular inflammation is indicated by the experiments of Jones and Meyer.

The few cases in which cortisone has been used locally are shown in Table 3. A brief description of these cases and the results obtained follow.

CASE 10 (534258)

This case has already been reported as Case 8 treated systemically. Immediately following the first course of parenteral cortisone, there was a relapse of external inflammation and exudation in the vitreous. Cortisone was now instilled locally for a period of eight days. Within 12 hours, there was a complete clearing of all external inflammation and a control of intraocular pressure, but there was no effect on the vitreous clouding nor any improvement in vision.

The local use of cortisone had little effect on the circulating eosinophils, the only change observed being a fall from 577 to 400. In the effort to clear the vitreous a second course of cortisone was given parenterally. However, this again produced no changes in the circulating eosinophil count and no effect on the eye. The observations in this patient suggested that, although the local instillation of cortisone in the conjunctival sac controlled the ciliary congestion, it had no effect on the vitreous clouding.

CASE 11 (536264)

Vernal catarrh. In April, 1944, an 18-year-old Negro, with a family history of tuberculosis, developed a bilateral conjunctivitis, characterized by the formation of huge follicles in the palpebral conjunctiva and vascularization and infiltration of the

* Merck and Company have recently made available an ophthalmic preparation of cortisone in buffered solution with a preservative. This preparation was made available through the courtesy of Dr. J. M. Carlisle.

corneas. There had been some improvement in November, followed by an exacerbation which continued up to the time of admittance in May, 1950.

Exhaustive studies in other clinics, including biopsy, animal inoculations, and cultures, had not revealed any etiologic factor. There were many eosinophils in the conjunctival discharge. Biopsy of a follicle showed lymphoid hyperplasia with a surrounding zone of eosinophils—the histologic picture of vernal catarrh. On admittance the corneas were completely opaque and heavily vascularized. The palpebral conjunctivas were the sites of massive follicular hypertrophy.

The patient was given 300 mgm. of cortisone parenterally on the first day, and 200 mgm. on the second. There was a marked drop in the circulating eosinophils and a slight improvement in the subjective picture. The intramuscular injection of cortisone was discontinued, and the local instillation of the hormone in the conjunctival sac substituted. Within 12 hours, there was a marked objective improvement and within eight days the cornea cleared to the extent that the irides could be clearly seen. The follicles rapidly diminished in size. Vision rose from hand movements in each eye to: R.E., 20/200; L.E., 20/100.

Cortisone therapy was terminated after 14 days of treatment. At this time vision was: R.E., 20/100; L.E., 20/40. The patient was then given beta irradiation to clear the remaining follicles and the corneal vascularization. Figures 12 and 13 show the appearance of the right eye before and after cortisone therapy and Figures 14 and 15, the appearance of the left eye before and after cortisone therapy.

TABLE 3
LOCAL USE OF CORTISONE

No.	Diagnosis	Treatment	Result
534258	Tuberculous uveitis, secondary glaucoma	Cortisone locally	Local use of cortisone controlled all evidence of external inflammation and glaucoma. No effect on vitreous clouding
536264	Vernal catarrh	Cortisone systematically for 2 days; locally for 12 days	Marked regression of lymphoid follicles. Control of inflammation. Clearing of corneas. Vision rose from H.M. to 20/100 and 20/40 (−).
Ambulant S. S.	Nongranulomatous iritis, secondary glaucoma	Cortisone locally	Clearing of all external inflammation. No effect on vitreous clouding. Control of tension from 70 mm. to 15 mm. Hg
148260	Sclerokeratitis	Cortisone locally	Control of external inflammation
117384	Pemphigus (?)	Cortisone locally	Marked temporary (?) improvement
548152	Alkali burns of corneas	Cortisone locally 36 hrs. after injury	Control of symblepharons and vascularization of corneas. No effect on corneal clouding
538178	Nongranulomatous iritis	Cortisone locally	Complete control of all external inflammation in 72 hours. Vision rose from 20/70 to 20/20
538999	Sympathetic ophthalmia	Cortisone locally	Complete clearing of all inflammation. No improvement in vision

CASE 12 *(S.S. ambulant)*

A white woman, aged 40 years, had an active granulomatous uveitis of four months'

duration, with a secondary glaucoma. The ocular tension measured 70 mm. Hg (Schiøtz). The etiology of the uveitis has not been established. Efforts to control the tension by paracentesis had been without success.

Local cortisone therapy was begun May 12, 1950. Within three days the pericorneal congestion had subsided, the eye whitened, and the tension fell to 15 mm. Hg. The aqueous flare which had formerly been positive, was entirely negative. Heavy vitreous veils were unaffected and vision remained unchanged at 10/400.

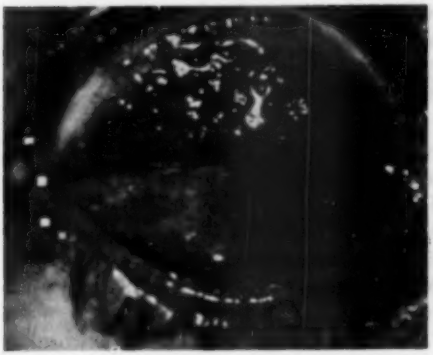


Fig. 12 (Woods). Right eye in Case 11 before treatment.

Fig. 14 (Woods). Left eye in Case 11 before treatment.

CASE 13 (148260)

A 50-year-old white woman, with a long history of tuberculous sclerokeratitis, had shown marked improvement after two courses of streptomycin and promizole. A low-grade intermittent scleritis with some edema of the lids persisted in spite of intense antibiotic and sulfonamide therapy. Cortisone 1.0 cc./25 mgm. was given with an immediate subjective improvement. However, it was followed by an irritation conjunctivitis. The cortisone was then diluted 1:3 and was now tolerated without reaction. Within four days there was a marked improvement in the inflammatory symptoms with subsidence of the lid edema.

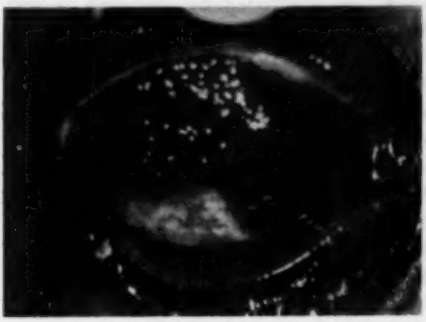


Fig. 13 (Woods). Right eye in Case 11 after treatment.

Fig. 15 (Woods). Left eye in Case 11 after treatment.

CASE 14 (117384)

A white woman, aged 70 years, with an extended history of rheumatoid arthritis, had an uneventful extraction of a left cataract in 1947. Following removal of the sutures an endophthalmitis developed which was controlled by antibiotics and sulfonamides. Later a secondary glaucoma developed which was controlled by operation, a full 20/20 vision resulting.

In January, 1950, the eye developed a keratoconjunctivitis with degeneration of the corneal epithelium and loss of all corneal sensitivity. Animal inoculations, cultures, and conjunctival scrapings were all negative. Antibiotic and sulfonamide therapy had no effect. The inflammation steadily progressed with an overgrowth of lymphoid tissue over the cornea and the formation of symblepharons above and below, with obliteration of the cul-de-sacs. The picture exactly resembled an ocular pemphigus. Beta ray therapy had no effect.

Local cortisone was started on May 16, 1950. Within 48 hours, there was a marked improvement, the acute inflammation disappearing and the lymphoid overgrowth on the cornea regressing. There was little or no change in the symblepharons. Synchronous with this there was a dramatic improvement in the arthritic symptoms.

CASE 15 (548152)

A 34-year-old white woman with an unimportant past history sustained an alkali burn of her face, head, and both eyes from a can of Drano, to which she had added hot water. When admitted to the Wilmer Institute three days later her vision was reduced to 10/15 in the right eye and 10/70 in the left eye. There was bilateral chemosis and blanching of the exposed bulbar congestion. The corneas were hazy and symblepharons were forming in the left lower conjunctival sac. There was some clouding of the anterior capsule of each lens and a strongly positive aqueous flare. The prognosis appeared to be poor.

The patient was placed on local cortisone therapy, the only other therapy being breaking the symblepharons with a glass rod and the early use of a conformer. Cortisone therapy was started on May 12, 1950, and continued for 12 days. The chemosis subsided completely. There was no vascularization of the corneas and the symblepharons did not reform. The cornea clouded somewhat and a descemetocele developed in the left eye, which ultimately ruptured.

CASE 16 (538178)

A farmer, aged 37 years, had had an attack of acute iritis in the left eye in 1947. The past medical history was negative, except for arthritic symptoms of three weeks' duration. The left eye had been inflamed for one month and for the previous two weeks has been the site of an active nongranulomatous iritis.

On admission there was violent pericorneal congestion and marked ciliary tenderness. The pupil was dilated under a mydriatic, the iris was thickened with a blurring of the normal patterns and markings. There were no nodules or synechias. Slitlamp examination showed the remains of fibrin in the anterior chamber. There were no keratic deposits, but the aqueous ray was strongly positive. Vision was 20/70.

Cortisone was given locally. After three days of treatment, all ciliary tenderness disappeared, the eye became white and free from inflammation, the aqueous ray was almost imperceptible, and corrected vision rose to 20/20. After three days of treatment, the eosinophil count fell to 32, after six days to 0, and returned to 133.3 after treatment was discontinued.

CASE 17 (538999)

Sympathetic ophthalmia. A 76-year-old white woman had had sympathetic ophthalmia for three and one-half months following a cataract extraction on the left eye. The exciting eye had not been enucleated. There had been a partial remission of the inflammation of the left eye followed by a violent exacerbation of about two weeks' duration.

When first seen, both eyes were violently inflamed with marked ciliary tenderness and pain. The tension was normal and the cornea was grossly clear. Vision in the right eye was reduced to light perception and projection. There was advanced capsular clouding of the lens, with advanced posterior cortical opacities. There were large keratic deposits and a strongly positive aqueous flare. The left eye was in phthisis with questionable light perception. There were heavy keratic deposits and a strongly positive aqueous flare.

The patient was placed on cortisone topically in the usual dosage. This was the only treatment. Within 48 hours, all ciliary tenderness and pain had disappeared and the ciliary congestion was much improved. After four days of treatment, there was only a trace of ciliary congestion and, after 11 days' treatment, the eyes were white and free from any external evidence of inflammation. The aqueous flare was still positive in both eyes. The greasy deposits on the posterior surface of the corneas had absorbed. There was no change in vision. The eosinophil count fell from 206 to 133 after four days of treatment with cortisone topically.

Discussion

An over-all survey of these cases reveals certain interesting findings. First, the beneficial effects of the adrenal-cortex hormones on ocular disease appear primarily to be a control of the inflammatory and exudative phases. When these agents are administered parenterally, these beneficial effects are manifested by a clearing of circumcorneal congestion, clearing of the vitreous, circumscription of exudates, and disappearance of subretinal edema. The beneficial results were invariably accompanied by a marked drop in the eosinophil count, often to the point of complete suppression.

When cortisone is given locally by instillation in the conjunctival sac, there again appears to be a subsidence of external inflammation and exudation, with resulting control of secondary glaucoma. From the meager evidence at hand, it seems possible that the local instillation of cortisone has little appreciable effect on exudation in the vitreous.

In the majority of the conditions in which the blocking effect on inflammation was observed there was some reason to suspect an allergic factor or background for the inflammatory reaction. Nongranulomatous iritis is currently believed to be a phenomenon due to bacterial hypersensitivity. In tuberculous disease, the inflammatory phase is dependent upon a hypersensitivity of the tissues to tuberculoprotein; in sympathetic ophthalmia there is sound reason to believe that hypersensitivity to uveal pigment is a part of the symptom complex.

Harvey and his co-workers have clearly demonstrated that these agents are capable of blocking the clinical symptomatology of various other allergic diseases; for example, asthma nasal polyps and drug hypersensitivity reactions.

In the exploration of the question of how these agents act on acute ocular inflammation and edema, it seemed pertinent first to investigate experimentally their effect on recognized allergic inflammatory ophthalmic reactions. The details of the various experiments on the influence of the systemic administration of ACTH and cortisone and the local use of cortisone on ocular inflammation will be reported in detail elsewhere. They are reported here only in summary. These experiments were done in collaboration with my associate, Dr. Ronald M. Wood.

Experimental action of ACTH and Cortisone on ocular inflammation

There are three basic experimental anaphylactic and allergic ocular reactions recognized: (1) The anaphylactic reaction due to sensitization and intoxication with protein agents, first described by Nicolle and Abt,[15] in 1908; (2) the allergic "ophthalmic" reaction due to sensitization and intoxication with bacterial antigens, first described by Derick and Swift,[16] in 1929; (3) the focal

reaction, long recognized clinically, and described experimentally in tuberculous eyes after the systemic injection of tuberculin by Woods and Burky, in 1943.[17] The influence of ACTH and cortisone on these three reactions was investigated experimentally in rabbits.

EXPERIMENT I

Protein hypersensitivity—Parenteral use of ACTH and cortisone. A series of six rabbits were sensitized to horse serum in the usual manner, serum titers of from 1:3,200 to 1:12,800 resulting. Two rabbits were left untreated as controls, two others were treated with cortisone, and two with ACTH for a period of four days prior to intoxication and four days after intoxication. After the four days' preliminary treatment all rabbits, controls and treated, were given an intoxicating injection of horse serum in the anterior chamber. The cutaneous sensitivity was determined before and after treatment.

The results of this experiment are shown graphically in Figure 16. The control animals showed a prompt and violent ophthalmic reaction. One of the rabbits treated with ACTH showed no reaction, while the second ACTH -treated rabbit showed a mild reaction. Both rabbits treated with cortisone showed a complete blocking of the anaphylactic ocular reaction. The cutaneous reaction was affected to a lesser degree than the reactions in the eye.

One month after cessation of treatment, all rabbits were again given both anterior-

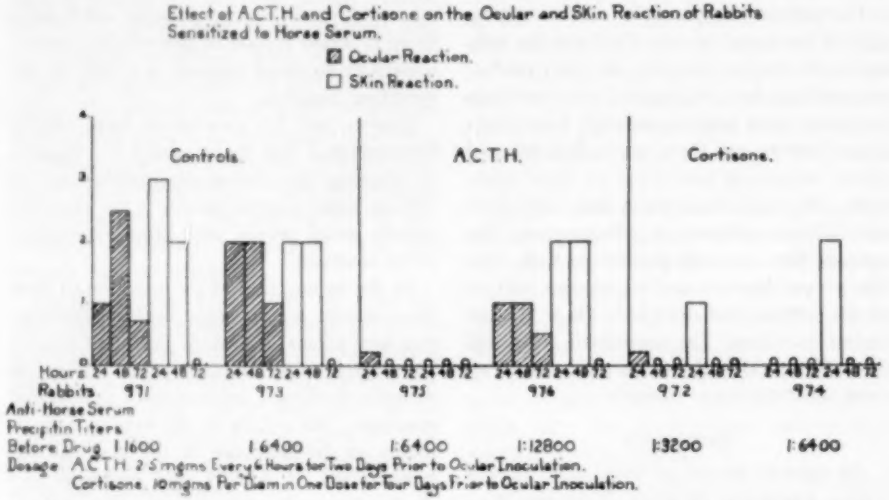

Effect of A.C.T.H. and Cortisone on the Ocular and Skin Reaction of Rabbits Sensitized to Horse Serum.
Ocular Reaction.
Skin Reaction.
Controls.
A.C.T.H.
Cortisone.
Hours 24 48 72 24 48 72 24 48 72 24 48 72 24 48 72 24 48 72 24 48 72 24 48 72 24 48 72 24 48 72
Rabbits 971 973 975 976 972 974
Anti-Horse Serum Precipitin Titers Before Drug 1:1600 1:6400 1:6400 1:12800 1:3200 1:6400
Dosage A.C.T.H. 2.5 mgms. Every 6 Hours for Two Days Prior to Ocular Inoculation.
Cortisone. 10 mgms. Per Diem in One Dose for Four Days Prior to Ocular Inoculation.

Fig. 16 (Woods). Effect of cortisone and ACTH in inflammatory phase of ophthalmic protein reaction.

chamber and intracutaneous injections of horse serum and all rabbits now reacted with marked and equal ophthalmic and cutaneous inflammation—all blocking effects of the ACTH and cortisone having completely disappeared. The precipitin titers in the blood serum were not altered by the administration of the ACTH and cortisone.

EXPERIMENT II

Quantitative relationship of treatment to blocking action. A series of rabbits were sensitized to horse serum. Four rabbits were

left untreated as controls, four animals received 10 mgm. of cortisone for four days prior to anterior-chamber injection, and for four days thereafter. Four others received 5.0 mgm. per diem in a similar manner, and four received 2.5 mgm. After four days of treatment, all rabbits were given anterior-chamber injections of horse serum.

rabbits were left untreated as controls, and three were given cortisone for four days prior to intoxication and for seven days after intoxication. After the four days of preliminary treatment with cortisone, all rabbits were given an intoxicating anterior-chamber injection of the bacterial antigen.

Within 24 hours the controls developed

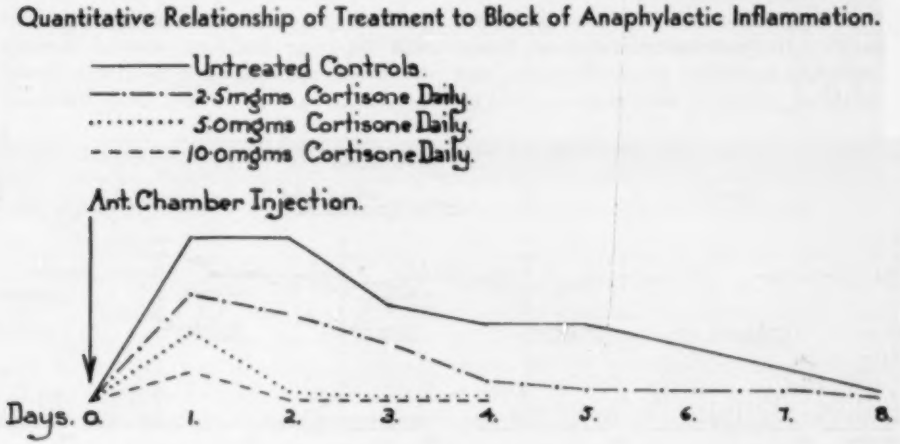

Quantitative Relationship of Treatment to Block of Anaphylactic Inflammation.
Untreated Controls.
2.5mgms Cortisone Daily.
5.0mgms Cortisone Daily.
10.0mgms Cortisone Daily.
Ant. Chamber Injection.
Days. 0. 1. 2. 3. 4. 5. 6. 7. 8.

Fig. 17 (Woods). Quantitative relationship of treatment to blocking effect.

The untreated controls responded in the usual manner with a violent reaction. The four receiving 10 mgm. per diem showed an almost complete blocking of the inflammatory reaction. The four receiving 5.0 mgm. per diem showed a similar blocking, but not as complete as the rabbits receiving the larger amounts. The rabbits receiving 2.5 mgm. per diem showed only a partial blocking. These results are shown graphically in Figure 17. Quite evidently the degree of blocking effect on the inflammatory reaction is proportional to the amount of cortisone administered.

EXPERIMENT III

Bacterial hypersensitivity. A series of normal rabbits were sensitized to killed Beta streptococci in the usual manner and all developed marked cutaneous reactions. Two

an acute iritis with pericorneal injection, clouding of the cornea, inflammation and edema of the iris, and fibrin in the anterior chamber. This reaction was of 5 to 9 days' duration.

The cortisone-treated rabbits behaved quite differently. In one animal there was no reaction of any kind to the intoxicating anterior-chamber injection; in the second there was a minimal transient traumatic reaction; while the third, the most sensitive of the group, showed a weak ophthalmic reaction of three days' duration. The cutaneous reactivity to the bacterial antigen was slightly suppressed, but definitely to a less extent than the ophthalmic reaction. These results are shown graphically in Figure 18.

One month after cessation of treatment, all rabbits, both controls and those formerly treated, were tested again with anterior-

chamber and intracutaneous injections of the bacterial antigen. Marked and equal reactions were found both in the controls and the formerly treated animals; all blocking action of the cortisone had disappeared.

EXPERIMENT IV

The focal reaction. A series of rabbits were rendered immune-allergic by the systemic injection of virulent human tubercle bacilli. After well-marked cutaneous hypersensitivity to purified protein derivative had developed, all rabbits were given a second injection of living bacilli in the anterior chamber. All eyes showed a transient reaction to the tuberculin in the inoculum.

After three weeks, signs of early ocular tuberculosis were present in all eyes. The animals were then divided into three groups of six rabbits each.

One group was left untreated as controls, and the second group was treated with ACTH and the third group with cortisone. After four days of treatment, all rabbits were given a shocking dose of 100 mgm. old tuberculin, subcutaneously. The controls still showed a violent focal reaction in the diseased eyes. Two of the rabbits treated with ACTH showed a moderate focal reaction, while four showed either a minimal traumatic reaction or no reaction of any kind.

One of the rabbits treated with cortisone showed a minimal focal reaction, while in five animals there was no reaction of any kind. ACTH was discontinued four days after this first shocking dose of tuberculin was given, but cortisone treatment was continued in the Group-III rabbits.

A second shocking dose was given all animals three weeks later. The controls again all reacted violently. Three of the rabbits formerly treated with ACTH now showed focal ocular reactions; two of the rabbits still receiving cortisone showed minimal traumatic reactions; while the others showed no ocular reaction of any kind. Cortisone was now discontinued in the Group-III rabbits.

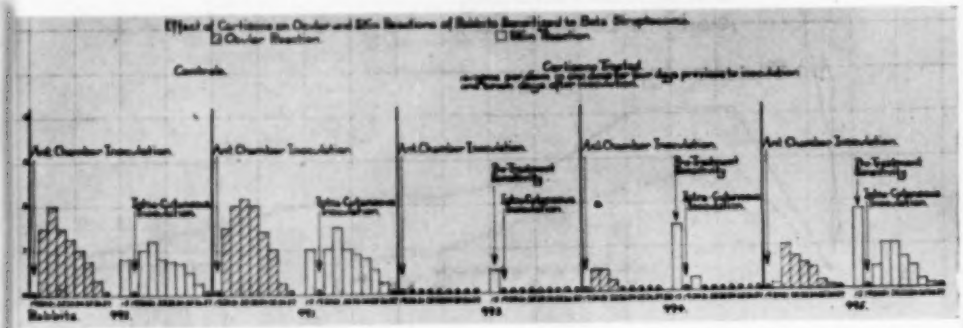


Fig. 18 (Woods). Effect of cortisone on inflammatory phase of ophthalmic bacterial allergy reaction.

Two weeks later all rabbits were given a third shocking dose of tuberculin. All rabbits, both controls and formerly treated animals, now showed acute and equal ophthalmic reactions. All blocking effect of the ACTH and cortisone had disappeared five and two weeks, respectively, after discontinuing treatment. These results are shown graphically in Figure 19.

One peculiar finding was noted in the animals treated with cortisone. The number and size of the tubercles in the iris continued to increase but, as long as the cortisone treatment was continued, there was a complete absence of any external inflammation, the picture being that of a progressive tuberculosis in an eye totally devoid of any inflammatory reaction.

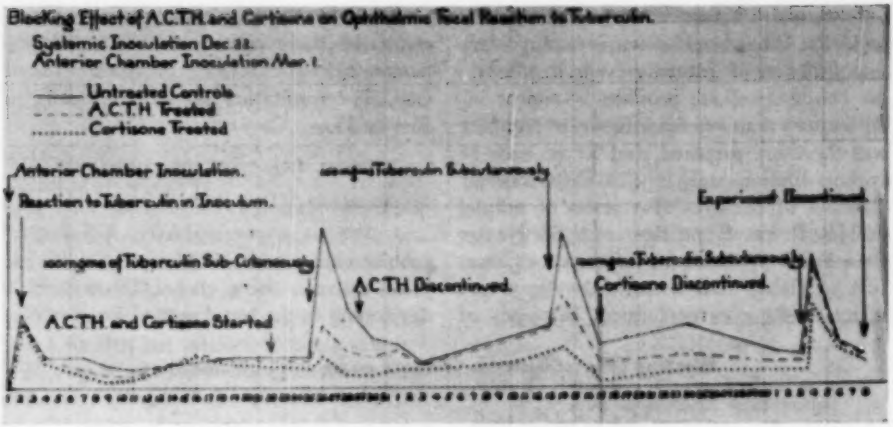


Fig. 19 (Woods). Effect of cortisone on inflammatory phase of local reaction to tuberculin.

From these experiments it is evident that both ACTH and cortisone can either completely or partially block the inflammatory and exudative phase of the protein anaphylactic and of the bacterial allergic reaction, and can also block focal reactions to tuberculin in tuberculous eyes. These agents, however, did not appear to alter the underlying hypersensitive state, the animals reacting to the specific antigen in the usual manner after the hormones were discontinued.

Obviously the next point to determine was whether or not these agents had a similar blocking effect on ocular inflammation unrelated to a hypersensitive state. This question was explored by determining the effect of systemic injection of ACTH and cortisone on the inflammatory reaction which follows the injection of such irritants as glycerin and jequirity in the anterior chamber.

EXPERIMENT V

A. Ocular inflammation secondary to glycerin. In 1931 Seegal and Seegal,[18] in the course of experiments on local tissue hypersensitiveness, showed that the introduction of such irritants as glycerin in the anterior chamber produced a transient iritis. Five rabbits were given four days of preliminary treatment with cortisone and then given an anterior-chamber injection of the proper amount of glycerin. Cortisone was continued for a further period of four days. Five untreated rabbits were similarly inoculated as controls.

All the controls showed a moderate iritis of three days' duration. In the treated rabbits, one showed a minor traumatic reaction, while the remaining four showed no iritis of any kind, the only change noted being a minor clouding of the lower half of the cornea due apparently to a disturbance of the endothelium. This was shown likewise by all the controls. These results are shown graphically in Figure 20.

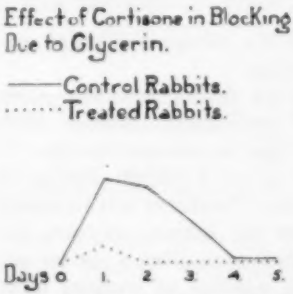


Fig. 20 (Woods). Effect of cortisone on inflammation secondary to glycosis in anterior chamber.

B. Ocular inflammation secondary to jequirity. It has been known for many years that infusion of jequirity seeds instilled in the conjunctival sac produces a violent inflammatory reaction. An infusion of jequirity was therefore prepared, and 0.1 cc. each of various dilutions were injected in the anterior chamber of the eyes of a series of normal rabbits. It was found that strengths greater than 1:500 produced an inflammatory reaction so violent that necrosis developed and many of the eyes perforated. Infusions of 1:4,000 produced a satisfactory iritis of several days' duration.

A series of six rabbits were then given four days of preliminary treatment with cortisone and then an anterior-chamber injection of 0.1 cc. of a 1:4,000 dilution of jequirity infusion. Treatment was continued four days after the jequirity injection. Six untreated rabbits were given a similar anterior-chamber injection of jequirity infusion. The treated rabbits showed no reaction to the jequirity injection, while the untreated controls showed a mild transient iritis which faded on the second day.

On the third day all rabbits were given a second anterior-chamber injection of 0.1 cc. of a 1:2,000 infusion. The control rabbits reacted with a marked increase in the ocular inflammation. The treated rabbits showed no reaction of any kind for 48 hours while the cortisone injections were continued. However when the cortisone was discontinued, there was an immediate mild inflammatory reaction in the previously treated eyes. The results are shown graphically in Figure 21.

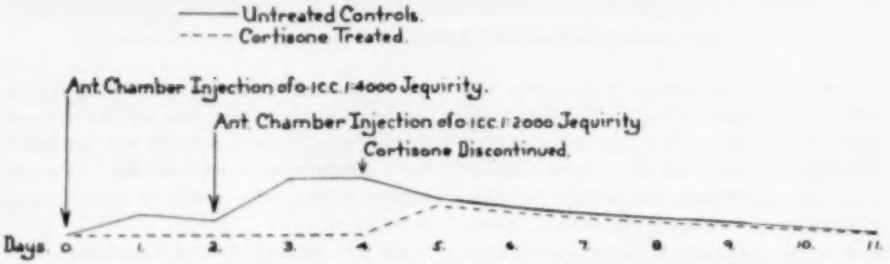

Blocking Effect of Systemic Cortisone on Jequirity Inflammation.
Untreated Controls.
Cortisone Treated.
Ant. Chamber Injection of 0.1 cc. 1:4000 Jequirity.
Ant. Chamber Injection of 0.1 cc. 1:2000 Jequirity
Cortisone Discontinued.
Days. 0 1 2 3 4 5 6 7 8 9 10 11

Fig. 21 (Woods). Blocking effect of systemic cortisone treatment on jequirity inflammation.

Local injection of cortisone

Experiment VI

A. Protein hypersensitivity. A series of rabbits were sensitized to horse serum in the usual manner, titers of 1:1,600 to 1:3,200 developing in the blood serum. Four rabbits were now injected in the anterior chamber of the right eye with a 0.1 cc. of horse serum and 1.25 mgm. of cortisone. In the left eye they were given 0.1 cc. of horse serum and 0.25 mgm. of cortisone. Four other sensitized rabbits (controls) were given 0.1 cc. of horse serum alone in the anterior chamber.

The controls developed a violent inflammatory reaction characterized by pericorneal inflammation, clouding of the cornea, inflammation of the iris, and a fibrinous exudate in the anterior chamber. Two of the eyes injected with 1.25 mgm. of cortisone and horse serum in the anterior chamber showed no reaction of any kind; one showed a minor traumatic reaction; while the fourth, a highly sensitive rabbit, showed a definite reaction of moderate intensity. One of the eyes receiving 0.25 mgm. cortisone in the anterior chamber showed no reaction; one a minor traumatic reaction; one a very mild anaphy-

lactic reaction; while the fourth (the same rabbit which showed a reaction in the fellow eye after the injection of 1.25 mgm.) showed a moderately severe anaphylactic reaction. These results are shown graphically in Figure 22.

The local injection of 1.25 mgm. of cortisone in the anterior chamber effectively blocked the inflammatory phase of the protein reaction in 3 of 4 animals so tested, and decreased the severity of the reaction in the fourth animal. The injection of 0.25 mgm. had a similar, but weaker, blocking action.

B. Jequirity inflammation. Six normal animals were given anterior-chamber injections of 1.25 mgm. of cortisone and 0.1 cc. of a 1:4,000 jequirity infusion. Two days later they were given a second anterior-chamber injection in both eyes of 1.25 mgm. of cortisone and 0.1 cc. of a 1:2,000 jequirity infusion. Six control rabbits were given similar anterior-chamber injections of jequirity infusions alone.

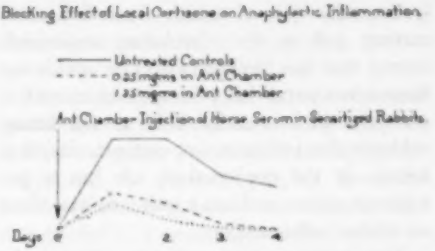


Fig. 22 (Woods). Blocking effect of local cortisone on anaphylactic inflammation.

The control rabbits reacted with a mild transient iritis to the first injection and with a more marked inflammatory reaction to the second injection. The rabbits receiving cortisone with the jequirity injections showed no reaction of any kind to the first anterior-chamber injection; and four of the six rabbits showed no reaction for 24 hours to the second stronger injection; the remaining two showed a very minor reaction. After 24 hours, no further cortisone having been injected, 10 of the 12 eyes showed a delayed inflammatory reaction which lasted for seven days. This reaction was somewhat more intense than in the controls. These results are shown graphically in Figure 23.

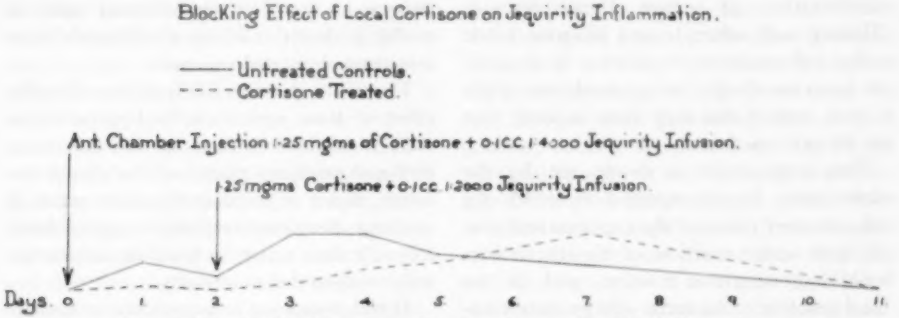

Blocking Effect of Local Cortisone on Jequirity Inflammation.
Untreated Controls.
Cortisone Treated.
Ant. Chamber Injection 1.25 mgms of Cortisone + 0.1 cc. 1:4000 Jequirity Infusion.
1.25 mgms Cortisone + 0.1 cc. 1:2000 Jequirity Infusion.
Days. 0 1 2 3 4 5 6 7 8 9 10 11

Fig. 23 (Woods). Blocking effect of local cortisone on jequirity inflammation.

To determine how long the protection against jequirity inflammation would last, three rabbits were given an anterior-chamber injection of 1.25 mgm. of cortisone alone. Three days later they were given 0.1 cc. of a 1:4,000 jequirity infusion.

All three rabbits showed a moderate inflammatory reaction. Quite evidently the blocking effect of the previous cortisone injections had disappeared.

Comment

The clinical observations herein reported are quite similar to those reported by other

observers and indicate that ACTH and cortisone have a profound effect on the inflammatory and exudative phases of ocular disease. It is further evident from the cases treated systemically (all of which showed a concurrent fall in the circulating eosinophil count) that this blocking effect on ocular inflammation paralleled evidences of increased adrenal cortex activity. The accumulating evidence also indicates that cortisone instilled locally in the conjunctival sac has a peripheral action, and has a quite similar effect on ocular inflammation.

Two questions immediately arise: (1) How do these agents act—through what mechanism do they exert this remarkable effect? (2) What is the place of these agents in ocular therapeutics?

Inasmuch as ACTH and cortisone have a similar effect in blocking the symptomatic manifestations of certain allergic diseases (Harvey and others), and likewise block ocular inflammation which may be dependent upon an allergic background, one might at first suspect that they alter in some way the allergic reaction.

This supposition is borne out by the experiments herein reported in which the inflammatory phase of the experimental anaphylactic ocular reaction, of the similar bacterial hypersensitive reaction, and of the focal reaction of bacterial allergy were completely or partially blocked. However, despite these demonstrations it appears that their fundamental action is not on the allergic reaction *per se*, but that they function independent of the hypersensitive state.

The evidence in favor of this is, first, that the antibody titer of the serum of the experimental animals is completely unaffected; second, that when the experimental animals are reëxamined 2 to 3 weeks after the cessation of treatment, when the effects of these hormones have worn off, the underlying hypersensitive state is found undisturbed and the eyes and skin of these animals again react to contact with the specific antigen in the usual manner.

It might, of course, be argued that, in some way, through an alteration in the permeability of the cell membrane, through some action on complement, through an antihistaminic action, or by some as yet undetected and unsuspected mechanism, these agents temporarily inhibit the antigen-antibody reaction. There is, however, no evidence in favor of this, and considerable evidence against such a supposition.

It is shown here that, in normal animals, these agents can block the ocular inflammatory reaction due to irritants—an inflammation quite independent of the allergic reaction. Further, as yet unreported experiments by Landau and his co-workers,[19] have shown that these agents will not protect experimental guinea pigs against histamine shock and death, and that strips of intestinal muscle from sensitized guinea pigs, treated with ACTH, react to contact with the specific antigen in the Dale phenomenon quite as readily as do strips of intestinal muscle from sensitized untreated animals.

Therefore it seems fairly evident that the effect of these agents on the hypersensitive state is confined to blocking the inflammatory and exudative phases of the allergic reaction, and it is probable that their action in blocking allergic inflammation is quite identical with their action in blocking nonallergic inflammation due to irritants.

If this reasoning is correct, the immediate question is how do these agents block the inflammatory reaction. Obviously one would suspect some action on the mesenchymal cells, the connective tissue of the vascular and lymphatic systems. This would explain not only the blocking effect of these agents on inflammation and exudation, but also their favorable effect on collagenous disease. But how they act on mesenchymal tissue is not apparent. One might suspect some action on capillary or cell permeability or some antienzymatic action. As yet there is, however, no evidence in favor of such suppositions and it is obvious that the question requires much further investigation.

It was interesting that, in the experiments herein reported, the inflammation-blocking

effect of these adrenal cortex hormones could be more effectively demonstrated in the eye than in the skin. This may well be due to the fact that the eye with its rich vascular and nervous tissues, completely encapsulated in the scleral-corneal envelope, is an ideal place to observe and follow isolated inflammatory reactions, and is much more selective than such a cosmopolitan structure as the skin. The high hyaluronic-acid content of the vitreous and cornea may also influence the outcome.

What are the practical therapeutic applications of this form of therapy in ophthalmology?

It is not altogether clear which agent is preferable for systemic use in the control of clinical ocular inflammation, although the balance seems to tip the scale in favor of ACTH. The optimum dosage and method of treatment are still to be determined. The evidence from the treatment of rheumatoid arthritis indicates that the beneficial effect may be only temporary in most instances.

In Case 1, herein reported, there was a severe recurrence of the iritis seven months after cessation of treatment with ACTH; and in all the experimental rabbits in which the inflammatory phase of the anaphylactic, bacterial hypersensitivity, and focal reactions was completely or partially blocked, the eyes and skin were again normally reactive when brought into contact with the specific antigen 2 to 3 weeks after the cessation of treatment. Thus, it would appear that, at best, only a temporary beneficial effect can be anticipated.

If these agents are to have any permanent place in ocular therapy, it seems probable they will be most valuable in conditions which are in their very nature self-limiting. Notable among such diseases are nongranulomatous iritis, allergic keratitis, and sympathetic ophthalmia. Somewhat similar would be a tuberculous uveitis with an acute inflammatory phase secondary to tissue hypersensitivity. If, in these conditions, the inflammatory, exudative, destructive phase of the lesion can be blocked sufficiently long for the normal defense mechanism of the body to take up the task of overcoming the infection, or for appropriate therapeutic measures—antibiotic and chemotherapy, desensitization, and so forth—to be instituted and accomplish their effect, then these agents may be of tremendous importance in ocular therapeutics.

The possibility of local use of cortisone in the eye is the most interesting and, for ophthalmologists, the most encouraging development. At present, judging from the small amount of clinical and experimental data available, it would appear that cortisone topically may have an immense field of usefulness in controlling external ocular inflammatory reactions. Whether it will have any effect on deep uveal inflammation when instilled in the conjunctival sac remains to be determined. Anterior-chamber injection, which appears efficacious in animals, is probably impossible in clinical cases.

If the topical administration does prove of value, such a finding will go a long way toward solving the economic question of its use. It was most interesting that several patients, notably the patient in Case 16, in whom cortisone was used topically, showed a marked drop in the eosinophil count, while in others only a slight or no effect was observed. Considerably more data will be needed to determine if a drop in the eosinophil count has any relation to the therapeutic action of cortisone used topically.

The ultimate side effects of these agents are as yet unknown. It must be remembered that these agents are about the most powerful hormones yet produced and may produce disastrous side effects. It is by no means clear how long the adrenal cortex can tolerate stimulation with ACTH or how damaging the depressant action on the adrenal cortex of exogenous cortisone may ultimately prove to be. These are only a few of the problems confronting workers in this field.

It would seem wise, for the present, to be conservative and to content ourselves with the assurance that, while these adrenal cortex hormones offer a new and powerful

weapon to control certain types of ocular inflammation and have opened vistas of possible therapeutic application, they should not yet be regarded as accepted or proved therapeutic agents.

Until more is known of their action, of the proper dosage, of the methods of treatment, of the ultimate results produced, of the occurrence of side effects, both ACTH and cortisone had best be excluded from the accepted therapeutic armamentarium of ophthalmologists and regarded only as exploratory agents. When employed therapeutically, their use should be limited to those conditions in which the severity of the ocular picture and the meager knowledge already accumulated warrant their use.

Summary

1. ACTH and cortisone given systemically have a profound effect in the control of ocular inflammation and exudation in the ocular humors.

2. Cortisone administered locally in the conjunctival sac has a similar effect on external ocular inflammation, the beneficial effects being uniformly observed after 2 to 4 days of intensive treatment. It has not yet been demonstrated that cortisone given topically has any effect on exudation in the vitreous.

3. The optimum method of treatment, either systemically or topically, has yet to be determined.

4. Experimental studies confirm the clinical observations. ACTH, administered systemically, and cortisone, systemically or topically, block in the eye the inflammatory and exudative phases of the anaphylactic protein reaction, of the bacterial allergic reaction, and of the focal reaction produced by the subcutaneous injection of tuberculin.

5. Both ACTH and cortisone given systemically appear to depress temporarily the cutaneous reactions incident to drug allergy and bacterial and tuberculin hypersensitivity.

6. Cortisone given either topically or systemically blocks the inflammatory reaction produced by such agents as glycerin and jequirity.

7. Although ACTH and cortisone block the inflammatory and exudative phases of the anaphylactic and allergic reaction, the evidence so far at hand indicates they have no effect on the underlying hypersensitive state.

8. The mode of action of ACTH and cortisone is as yet undetermined. It seems probable that they act in some way on the mesenchymal tissues.

The Johns Hopkins Hospital (5).

References

1. Hench, P. S., Kendall, E. L., Slocomb, C. H., and Polley, H. F.: Effect of hormone of adrenal cortex (17 hydroxy-11 dehydrocorticosterone: Compound E) and of the pituitary adrenocorticotrophic hormone on rheumatoid arthritis. Proc. Staff Meet., Mayo Clin., **24**:181, 1949.

2. Markson, D. E.: Treatment of arthritis with ACTH. J.A.M.A., **141**:458, 1949.
Boland, E. W., and Headly, N. E.: Cortisone acetate and rheumatoid arthritis. J.A.M.A., **141**:301, 1949.

3. Elkinton, J. R., Hunt, A. D., Godfrey, L. McCrory, W., Rogerson, A. D., and Stokes, J.: Effects of ACTH therapy. J.A.M.A., **141**:1273, 1949.

4. Thorn, G. W., Baylis, T. B., Massch, B. F., Forsham, P. H., Hill, S. R., Smith, S., and Warren, J. E.: Studies on the relation of pituitary adrenal function to rheumatic disease. New England J. Med., **241**:529, 1949.

5. Sprague, E. G., et al.: Observations on physiologic effects of cortisone and ACTH in man. Arch. Int. Med., **85**:199, 1950.

6. Gaunt, R., et al.: The adrenal cortex. Ann. N.Y. Acad. Sc., **50**:511, 1949.

7. Thorn, G. W., and Forsham, P. A.: Metabolic changes in man following adrenal and pituitary hormone administration. Recent Progress in Hormone Research. 1949, v. 4, p. 229.

8. Cushing, H.: Basophil adenomas of the pituitary body and their clinical manifestations (pituitary basophilism). Bull. Johns Hopkins Hosp., **50**:137, 1932.

9. Mann, W. A., and Markson, D. E.: A case of recurrent iritis and episcleritis on a rheumatic basis treated with ACTH. Am. J. Ophth., **33**:459, 1950.

10. Olson, J. A., Steffensen, E. N., Margulis, R. R., Smith, R., and Whitney, E. L.: ACTH in ophthalmic conditions. J.A.M.A., 142:1276, 1950.
11. Gordon, S. M., and McLean, J. M.: ACTH in ophthalmologic condition. J.A.M.A., 142:1271, 1950.
12. McLean, J. M.: Report at the ninth meeting of the Wilmer Residents Association, Baltimore, April 19, 1950.
13. Jones, I. S., and Meyer, K.: Inhibition of vascularization of the rabbit cornea by local application of cortisone. Presented at the 12th annual staff and alumni meeting of the Institute of Ophthalmology of the Presbyterian Hospital, New York, April, 1950.
14. Owens, W. C.: Report at the ninth meeting of the Wilmer Residents Association, Baltimore, April 19, 1950.
15. Nicolle, M., and Abt, G.: Les anticorps des albuminobes et des cellules. Ann. Inst. Pasteur, 22:132, 1908.
16. Derick, C. L., and Swift, H. F.: Reactions of rabbits to nonhemolytic streptococci: I. General tuberculin-like hypersensitiveness, allergy, or hyperergy following a secondary reaction. J. Exper. Med., 49:615, 1929.
17. Woods, A. C., and Burky, E. L.: Experimental studies on ocular tuberculosis: VII. Effect of desensitization with tuberculin in experimental ocular tuberculosis. Arch. Ophth., 29:369, 1943.
18. Seegal, D., and Seegal, B. C.: Local organ hypersensitiveness: III. Further observations on its experimental production in the rabbit eye. J. Exper. Med., 54:249, 1931.
19. Landau, S. W., Nelson, W. A., and Gay, L. N.: Adrenocorticotrophic hormone: Histamine reactions and anaphylactic death. In press.
Jones, T.: Report at the 12th annual staff and alumni meeting of the Institute of Ophthalmology of the Presbyterian Hospital, New York, April, 1950.

CHEMISTRY OF PITUITARY PRINCIPLES ACTING UPON OCULAR TENSION*

ALBERT A. DIETZ, PH.D., ERNST SCHMERL,† M.D., AND BERNHARD STEINBERG, M.D.
Toledo, Ohio

Schmerl and Steinberg[1] demonstrated the presence in the spinal fluid of two pituitary hormonal principles which act upon intraocular pressure. One principle increases and the other decreases the tension. It is not unlikely that these principles possess other functions by virtue of their effect upon sympathetic and parasympathetic centers. For sake of brevity, the increasing hormone will be referred to as hyperpiesin and the decreasing as miopiesin. Physiologically, they appear to be in equilibrium. The normal balance can be disturbed by several procedures including the exposure of an individual either to a bright light or to darkness. The spinal fluid of light-exposed persons contains an excess of miopiesin; whereas, in the dark-exposed subjects, the fluid contains a greater amount of hyperpiesin. The reverse is true in rabbits.

The mechanism by which these hormones induce changes of tension has been further investigated by Schmerl and Steinberg.[2] Within the limits of existing knowledge of nervous control, hyperpiesin was found to act on the parasympathetic centers with a resultant dilatation of ocular vessels. Miopiesin, on the other hand, affected the sympathetic and induced a contraction of blood vessels. By virtue of these effects upon the vascular bed of the eyes, an increase or a decrease of intraocular pressure took place. The purpose of the present article is to present some of the chemical characteristics of these hormones.

EXPERIMENTAL PROCEDURES AND RESULTS

Intraocular pressure was determined with the Schiøtz tonometer as described in a previous article.[3] Rabbits were used as test animals. Chemical fractions of spinal fluid

* From the Toledo Hospital Institute of Medical Research. This work was supported by a grant from the Snyder Ophthalmic Foundation.
† Research ophthalmologist of the Snyder Ophthalmic Foundation.

from humans and rabbits exposed to light or dark or under normal conditions were injected either subcutaneously or intravenously with quantities of 1.0 to 10 ml. of the original fluid. There were three groups of rabbits employed for testing. The first group consisted of normal animals. The second was composed of rabbits with cauterized ciliary ganglion and, in the third, the superior cervical ganglion had been extirpated.

The purpose of using the three groups was largely due to the inability of separating the two hormones chemically. The testing procedures enabled us to differentiate physiologically under more than one condition one principle from the other. Because of the limitation of available material, quantitative evaluations of the fractions were not done. The study was limited to the determination of absence or presence of the hormonal principles in each of the chemical fractions of the spinal fluid. Animals of the normal group were used for testing of fractions derived from spinal fluid of subjects with light or dark exposure. Other samples of spinal fluid were tested on rabbits with cauterized ciliary ganglia and those with extirpated cervical ganglia.

As investigations described elsewhere indicated,[2] cauterization of the ciliary and the consequent decrease in the impulse carrying capacity of the parasympathetic pathway diminished the action of hyperpiesin and allowed miopiesin of normal spinal fluid to lower the tension from 2.0 to 3.5 mm. Hg. On the other hand, removal of the cervical sympathetic ganglion decreased the load capacity of the sympathetic pathway. The effect of miopiesin was reduced and hyperpiesin in the same spinal fluid induced an increase in intraocular pressure of 4.0 to 8.0 mm. Hg. No change in tension was found when normal spinal fluid was injected into normal animals.

Chemical procedures

Spinal fluid was obtained from humans and from rabbits. Some of the subjects were exposed to moderately intense light, others to darkness and still others were not subjected to either procedure. The last type of spinal fluid will be referred to as "normal."

Spinal fluid was dialyzed, the solubility of the principles in glacial acetic acid, alcohol, perchloric acid, and acetone was determined and their adsorption by alumina and their stability were investigated. Their presence in urine and in blood of light- and dark-exposed animals was also investigated. Dried anterior pituitary material was subjected to several chemical procedures and the activity tested.

Stability

Spinal fluid was stored at 5°C. and the activity tested at intervals of several days. Activity of both hyperpiesin and miopiesin was retained for one week. After that period, there was a pronounced loss of the principles. Spinal fluid was heated over a boiling water bath for five minutes and the activity was found to be absent. Lyophilization of the spinal fluid preserved the hormonal principles for at least 6 to 8 months.

Dialysis

Spinal fluid from dark- and light-exposed subjects was dialyzed against a large volume of distilled water. The residue after dialysis did not contain either of the two hormones. This procedure indicated that both substances are of a low molecular weight. Dialysis of normal spinal fluid against a small volume of distilled water showed presence of both hyperpiesin and miopiesin in the dialysate but their physiologic activity was reduced. In this experiment, 10 ml. of lyophilized human spinal fluid was dissolved in 3.0 ml. of distilled water and dialyzed against three changes of distilled water, 3.0 ml. in each change.

Precipitation and solubility

To quantities of 1.0 to 3.0 ml. of spinal fluid obtained from light- or dark-exposed rabbits, were added three volumes of ace-

tone. The precipitate was centrifuged and separated from the supernatant. Each fraction was lyophilized. The supernatant contained both principles indicating their solubility in the concentration of acetone used.

To quantities of 5.0 ml. of normal lyophilized human spinal fluid was added 3.0 ml. of distilled water and 1.5 ml. of 1.8 *M* perchloric acid.[4] After allowing it to stand for 10 minutes, the mixture was centrifuged and the residue was washed with 0.6 *M* perchloric acid followed by 95-percent alcohol to remove the acid. To the supernatant solution was added 1.0 ml. of five-percent phosphotungstic acid in 2 *N* hydrochloric acid for each 5.0 ml. of the supernatant. It was centrifuged and the residue was washed with the same acid concentration followed by alcohol. Each residue was dissolved in water and adjusted to a neutral pH. Both of the hormonal principles were found in the first residue. This residue consisted of protein substances precipitated by perchloric acid.

To 1.0 to 10 ml. of lyophilized spinal fluid obtained from normal, dark- and light-exposed humans and rabbits, were added equal volumes of 70-percent of ethyl alcohol. The tubes were refrigerated for one hour with intermittent shaking and then centrifuged. To the supernatant was added an equal volume of absolute ethyl alcohol, refrigerated and centrifuged. The residues were washed with 70-percent and 85-percent alcohol, respectively, and dissolved in normal salt solution. All but the first step was carried out at 3°C. The saline solution of the precipitate forming between 70- and 85-percent alcoholic concentration contained both principles. Experiments in which alcohol concentrations of 70 to 77.5 and 77.5 to 85 percent were used showed division of the principles. There was, however, some indication that miopiesin was precipitated in greater concentration in the 70- to 77.5-percent alcohol fraction.

Since dialysis indicated that the principles are composed of relatively small molecules, we adopted the procedure that Kamm and his associates[5] used in fractionating pitressin and oxytoxin. To 3.0 ml. of lyophilized spinal fluid obtained from dark-exposed rabbits, were added 4.0 ml. of glacial acetic acid. The resulting residue was centrifuged, washed twice with 1.0 ml. glacial acetic acid. The acetic acid was removed in vacuo and the residue dissolved in water.

After centrifugation, the dissolved residue was tested for activity. Miopiesin was found to be present. To the supernatant obtained upon the primary addition of glacial acetic acid, was added ether and petroleum ether as outlined by Kamm and associates.[5] Neither of the principles were found to be present in any of the fractions. In the case of the hyperpiesin and miopiesin, they were insoluble in glacial acetic acid; whereas, the hormones tested by Kamm and associates were soluble. The fraction precipitating between 70- and 85-percent alcoholic concentration was insoluble in glacial acetic acid.

In several cases both the alcohol and perchloric acid fractionation methods were used. Lyophilized spinal fluid in 10 ml. quantity was extracted with 70-percent alcohol and the soluble portion precipitated by adding absolute alcohol to bring the concentration to 85 percent. The resultant residue was dissolved in water. The solution was then treated with perchloric acid as described above. The quantity of final residue was so small that it could be hardly seen. The active principles were present but some of the activity was lost.

Adsorption on alumina

To 1.9 ml. of spinal fluid obtained from dark-exposed rabbits was added 1.0 ml. of suspension of Al_2O_3 (1 gm. per 10 ml. of water). The mixture was allowed to stand for 30 minutes and centrifuged. Neither of the principles were found in the supernatant solution.

The residue was eluted with 0.02 *N* hydrochloric acid. The material was centrifuged and the residue separated from the

TABLE 1

PROPERTIES OF HYPERPIESIN AND MIOPIESIN

1.	Hyperpiesin acts on the parasympathetic centers, dilates ocular vessels, and increases intraocular pressure.
2.	Miopiesin acts on the sympathetic centers, contracts ocular vessels, and reduces intraocular pressure.
3.	Both principles are found in spinal fluid.
4.	They are not found either in the urine or in the blood under the conditions of our experiments.
5.	The principles dialyze through a semipermeable membrane.
6.	They are destroyed by heating over a boiling water bath for five minutes.
7.	Their activity is lost after seven days at 3°C., when preserved in spinal fluid.
8.	Lyophilization preserves the principles for several months.
9.	They are insoluble in glacial acetic acid but are soluble in 70-percent alcohol.
10.	They are precipitated by 85-percent alcohol and by 0.6 *M* perchloric acid.
11.	They are adsorbed by alumina and may be eluted with dilute hydrochloric acid.

supernatant. There was no activity in the residue. The supernatant showed presence of miopiesin, producing a decrease of intraocular pressure of −3 to −5 mm. Hg. This experiment demonstrated that miopiesin is adsorbed by alumina and can be eluted with dilute hydrochloric acid.

Adsorption and elution of urine of rabbits exposed to light and to dark did not reveal the presence of either principle. The blood from these animals gave no change in intraocular pressure on injection into other rabbits.

FRACTIONATION OF DRIED ANTERIOR PITUITARY

Dried anterior pituitary gland (VioBin) was subjected to the procedures employed with spinal fluid in previous experiments. Fresh anterior pituitary was found to contain hyperpiesin. The principles could not be extracted from the dried gland with 70-percent alcohol as was done with lyophilized spinal fluid. However, extraction was achieved with 0.5-percent acetic acid and isotonic phosphate buffer at pH 7.6.

These extracts were fractionated with 70- and 85-percent alcohol. With the acetic-acid extract, miopiesin was divided between the fractions insoluble in 70- and 85-percent alcohol. However, in the phosphate buffer extract, the activity was confined to the 70- to 85-percent alcohol fraction. The principle so obtained was dialyzed and only a portion of its activity was recovered in the dialysate. It required a considerable amount of the dried gland, 150 to 200 mg., to show activity.

SUMMARY

There are two pituitary hormonal principles found in the spinal fluid. One acts on the parasympathetic centers producing vasodilation and an increase in the intraocular tension. The principle is labeled hyperpiesin. Another principle acts on the sympathetic centers, producing vasoconstriction and decreasing intraocular tension. The priniciple is labeled miopiesin.

Several chemical procedures were applied to the spinal fluid and dried pituitary gland. Among other characteristics the hormonal substances were found to be of small molecular weight, dialyzable, heat labile, and adsorbable by alumina.

2805 Oatis Avenue (6).

REFERENCES

1. Scherml, E., and Steinberg, B.: Central control of intraocular pressure by active principles. Am. J. Ophth., 31:1097-1101, 1948.
2. ———: The role of ciliary and superior cervical ganglia in ocular tension. Am. J. Ophth., 32: 947, 1949.
3. ———: Determination of ocular tension and rigidity in rabbits. Am. J. Ophth., 29:1400-1404, 1946.
4. Winzler, R. S., Devor, A. W., Mehl, J. W., and Smyth, I. M.: Studies on the mucoproteins of human plasma: I. Determination and isolation. J. Clin. Investigation, 27:609-61, 1948.
5. Kamm, O., Aldrich, T. B., Grote, I. W., Rowe, L. W., and Bugbee, E. P.: The active principles of the posterior lobe of the pituitary gland: I. The demonstration of the presence of two active principles. II. The separation of the two principles and their concentration in the form of potent solid preparations. J. Am. Chem. Soc., 50:573-601, 1928.

GLAUCOMA*

A STATISTICAL REVIEW OF 816 PATIENTS WITH 1,112 GLAUCOMATOUS EYES

ALBERT N. LEMOINE, JR., M.D.
Kansas City, Missouri

INTRODUCTION

This paper is a statistical review of a large number of unselected glaucoma patients who were subjected to various types of medical and surgical treatment. The conclusions are based on the statistics obtained from a detailed analysis of each case.

The purpose of this review is to gather detailed statistical data concerning the diagnosis and treatment of glaucoma and to formulate efficient programs for handling glaucoma patients in clinics and private practice.

My interest in this problem resulted from observing the number of patients in whom glaucoma was advanced before the disease was recognized. At the same time, I was impressed by the divergent opinions as to the proper medical and surgical treatment of these patients. Although there are numerous studies of glaucoma patients in the medical literature, most of them are devoted to separate types of glaucoma or treatment. In this study all types of glaucoma subjected to various methods of treatment by many ophthalmologists at one institution are analyzed.

PROCEDURE

The material for this study was obtained by reviewing the hospital and clinic records of approximately 2,500 glaucomatous patients at the Massachusetts Eye and Ear Infirmary. The histories of all patients listed in the glaucoma files of the social service department were studied. The statistical data, unless stated otherwise, refer to glaucomatous eyes.

Of the 2,500 case histories, 816 were found suitable for detailed study. These 816 patients had a total of 1,112 glaucomatous eyes. The records not used were omitted for one or more of the following reasons: The patient had received medical or surgical treatment for glaucoma prior to being seen at the Massachusetts Eye and Ear Infirmary, the glaucomatous eye or eyes had been observed less than one year at this hospital, or the records were not complete. Most of the records were discarded because the patient had received treatment elsewhere.

The statistical data in this study were obtained by using a punch-card system. A code sheet was composed and one sheet was used for each glaucomatous eye. At the end of the code sheet there was a column for correlation of the two eyes and number of patients.

For ease of presentation and reference study, the detailed statistics are grouped as to types of glaucoma, and at the end of each section there is a summary of the significant data. Following the discussion of types of glaucoma there is a section in which all the glaucomatous eyes are grouped together with the general statistics as to signs, symptoms, and treatment.

A final section is devoted to plans for handling glaucoma patients in a clinic and in private practice. The importance of a social-service worker is discussed.

CRITERIA

In any study of this type the problem of definitions is important. The terms that may be misinterpreted are defined below.

An eye was considered glaucomatous if the tension was 40 mm. Hg (Schiøtz) or more and/or there was a definite glaucomatous field defect.

All observations and complaints refer to those at the time glaucoma was diagnosed:

1. Age—when diagnosis was made.

* From the Howe Laboratory of Ophthalmology, Harvard Medical School, and the Massachusetts Eye and Ear Infirmary.

2. Chief complaint—the main reason for seeking medical advice.

Routine—during the routine examination of old patients.

3. Corneal edema—limited to eyes with gross edema.

4. Anterior chamber—shallow or deep, limited to those with a definite statement as to depth. If questionably shallow or deep, listed as normal.

5. Iris—(a) Atrophy (any degree of gross atrophy); (b) new vessels (seen with or without the slitlamp); (c) posterior synechia (any degree); (d) anterior synechia (gross anterior synechia, not gonioscopic); (e) iris bombé (definite bombé, questionable cases excluded); (f) coloboma (surgical in aphakia).

6. Pupil—(a) Size (gross size, considered medium if there was no note as to size; (b) membrane (definite, dense pupillary membrane).

7. Lens exfoliation—exfoliation seen with the slitlamp.

8. Fundus—(a) Cupping (pathologic cupping of optic nerve); (b) atrophy (optic atrophy without cupping); (c) occlusion (complete or partial obstruction of vein or artery); (d) hemorrhage (other than an occlusion, or with diabetic retinopathy).

9. Vision—less than 20/200 includes all vision to light perception.

10. Tension—the first recorded tension when a definite diagnosis was made, not necessarily the highest tension. All tensions were taken with the Schiøtz tonometer.

11. Fields—the first field recorded when or after a definite diagnosis of glaucoma was made. (a) Nasal step (a definite nasal step of 10 degrees or more); (b) nasal step with Bjerrum's scotoma (nasal step of at least five degrees with Bjerrum's scotoma that did not extend to the periphery); (c) Bjerrum scotoma (Bjerrum's scotoma with 3/1,000 or larger test object and no nasal step); (d) loss of one-fourth field (sector defect involving approximately one-fourth of the field); (e) loss of one-half field (Bjerrum's scotoma breaking through to periphery, involving approximately one-half of the field); (f) loss of three-fourths field (central field of five or more degrees with no temporal island); (g) temporal field with central island (central island of any size with temporal field); (h) central island (less than five degrees of central field remaining); (i) temporal field (loss of central field with any degree of temporal field).

12. The definition of the type of glaucoma appears at the beginning of each section.

13. The complications following cataract extraction: (a) Vitreous loss (any amount of vitreous lost at the time of the cataract extraction); (b) iritis (all eyes with moderate or severe iritis more than four weeks after the lens extraction); (c) needling (eyes with one or more needlings for pupillary membrane); (d) no complication (apparently uneventful cataract extraction and postoperative course).

Treatment

1. Medical—eyes having no surgical procedure during the period followed.

2. Surgical—eyes having any type of surgical intervention.

3. Response to medication—eyes receiving only medical treatment: (a) Good (tension never over 24 mm. Hg (Schiøtz), and usually less than 20 mm. Hg. No visual loss attributable to glaucoma, and no loss of field during the period followed); (b) fair (tension never over 30 mm. Hg and/or slow field loss that, in view of patients' age, did not require surgery during the period followed); (c) poor (tension over 30 mm. Hg and/or a rapid loss of field during the period followed).

4. Type of medication—(a) Mild miotic (one-percent pilocarpine); (b) moderate miotic (two-percent pilocarpine or 0.75- to one-percent doryl), (few patients using doryl); (c) intensive miotics (four-percent pilocarpine, eserine ointment, and/or mecholyl and eserine drops); (d) combination

(a miotic and adrenalin); (e) mydriatic (any mydriatic alone).

5. Surgery—refers to the first surgical procedure except in a few eyes where a paracentesis or subconjunctival keratome incision into the anterior chamber was performed before a major glaucoma operation was done. (a) Trephine (any trephining operation); (b) iridencleisis (iris inclusion operation in which the sphincter was cut at least once but no cornea or sclera was removed); (c) iridencleisis with sclerectomy (as under (b) with a sclerectomy); (d) iridectomy (glaucoma iridectomy); (e) Lagrange (glaucoma iridectomy with sclerectomy); (f) cyclodialysis (cyclodialysis without sclerectomy or iridectomy); (g) posterior sclerotomy (any type); (h) cyclodiathermy (with flat or perforating electrode); (i) cataract (initial cataract extraction with no filtration procedure); (j) multiple surgery (more than one surgical procedure regardless of type).

6. Surgical results—(a) Good (tension never over 20 mm. Hg (Schiøtz), no visual loss attributable to glaucoma, no loss of field during the period followed after surgery); (b) fair (tension between 20 to 25 mm. Hg, and/or a slow loss of field during the period followed after surgery; may use miotics); (c) poor (tension over 25 mm. Hg, and/or a rapid field loss during the period followed after surgery; may use miotics).

7. Surgical complications—(a) Immediate infection (severe infection occurring within one month after surgery); (b) late infection (infection occurring later than one month after surgery); (c) immediate cataract (the development of a mature cataract within six weeks after a glaucoma operation); (d) late cataract (the development of lens opacities that decreased the visual acuity three or more lines six or more weeks after glaucoma surgery); (e) iritis and uveitis (process lasting more than six weeks after the glaucoma operation); (f) hemorrhage (expulsive, following surgery).

8. Result of cataract extraction—in any type of lens extraction following an initial glaucoma procedure, the central vision was not considered unless the loss was due to glaucoma. Good, fair, and poor refer to tension as under glaucoma surgery.

9. Period followed—refers to the elapsed time from the initial glaucoma diagnosis to the last visit.

All patients in this study were of the white race.

Tumors

In this study the records of eight patients with an intraocular tumor and glaucoma were found in the glaucoma files. This series is not large enough for detailed reporting, but it is significant that a tumor was not suspected in four (50 percent) of the eyes.

In any glaucoma study the importance of intraocular tumors in blind glaucomatous eyes in which the fundus cannot be visualized should be stressed. All of these tumors were melanosarcomas of the choroid, and in only one eye was the tumor itself seen. It is important that none of these patients had evidence of glaucoma in their other eye. Therefore, an intraocular tumor should be seriously considered in any patient with advanced unilateral glaucoma.

Blocked pupil

This is a recently described type of glaucoma found in patients with aphakia and dislocated lens. It is believed to be caused by blockage of the pupillary opening by vitreous or a pupillary membrane.

No cases are analyzed in this series, but the reader is referred to the paper presented to the Section on Ophthalmology of the American Medical Association in June, 1946, by Dr. Paul A. Chandler and Dr. Carl C. Johnson of Boston, Massachusetts.

Aphakic glaucoma

There were 71 patients with 77 glaucomatous eyes in this group. All cataract extractions were done at the Massachusetts Eye and Ear Infirmary, and the patients re-

ceived all glaucoma treatment at this hospital. None had evidence of glaucoma before their lens extraction. This group contained seven percent of all the glaucomatous eyes. The surgical procedures and results are recorded in Table I.

TABLE 1

SURGICAL PROCEDURES AND RESULTS IN APHAKIC GLAUCOMA

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	4 100	— —	— —	1 25	3 75
Iridencleisis with anterior sclerectomy	1 100	1 100	— —	— —	— —
Iridectomy	1 100	1 100	— —	— —	— —
Cyclodialysis	30 100	14 47	— —	6 20	10 33
Posterior sclerotomy	4 100	1 25	— —	1 25	2 50
Cyclodiathermy	1 100	1 100	— —	— —	— —
Paracentesis or subconjunctival incision	4 100	1 25	— —	1 25	2 50
Needling	1 100	— —	— —	— —	1 100
Multiple	18 100	1 6	4 22	13 72	— —

SUMMARY

The patients with aphakic glaucoma were, for the most part, in the older age group, 87 percent being over 50 years of age, which is to be expected. The sex distribution was approximately equal. The chief complaint in nearly 80 percent of the patients was either a red eye or pain. There was gross corneal edema in 62 of the eyes. The anterior chamber was of normal depth in 54 percent, deep in 25 percent, shallow in 11 percent, and contained vitreous in 10 percent.

The aqueous was clear (free of cells) in 84 percent of the eyes. There was a surgical coloboma in 82 percent of the eyes, with a dense pupillary membrane in 40 percent. In 77 percent fundus details were not visible.

The central vision was of no value in this study because too many eyes had no refraction. The initial tension was 40 mm. Hg or more in 85 percent of the eyes. The visual-field data are of no value because 80 percent did not have fields recorded.

There were too few lens extractions with a round pupil for conclusions as to the relative incidence of glaucoma in combined intracapsular extraction and round-pupil extractions. The most important finding was that 70 percent of the eyes had some type of complication during or following the cataract extraction. The most significant complications were vitreous loss in 30 percent, one or more needlings of secondary membranes in 18 percent, and prolonged iritis in 15 percent.

Thirty-nine percent had medical treatment, with 17 percent being well controlled. One or more surgical procedures were performed in 61 percent of the eyes. Cyclodialysis was the initial operation in 64 percent of the eyes and 47 percent of these had a good result. The other surgical procedures were too few for statistical correlation. If more than one operation was required, 72 percent had a poor result. There were no serious surgical complications. Eight percent of the glaucomatous eyes required enucleation.

Aphakia was bilateral in 51 percent of the patients. In the patients with bilateral aphakia, 14 percent developed glaucoma in both eyes.

Five percent of the patients were blind in one eye on the initial visit.

IRITIS AND UVEITIS

There were 61 patients with 73 glaucomatous eyes that appeared to be secondary to iritis or uveitis in either the acute or quiet stage. This group contained seven per-

cent of all the glaucomatous eyes. The surgical procedures and results are recorded in Table 2.

Summary

There was a wide span in the patients' ages, with 85 percent between 30 and 69 years of age. Sixty-eight percent of the patients were female. The chief complaint was either pain or a red eye in 75 percent of the patients. The cornea was grossly edematous in 60 percent and contained keratic precipitates in 22 percent.

The anterior chamber was normal in depth in 52 percent of the eyes and shallow in 40 percent. There were cells in the aqueous of 49 percent of the eyes. There were posterior synechias in 25 percent, iris bombé in 19 percent, and engorged vessels in the iris in 18 percent.

The lens was clear in 33 percent, and there was an immature cataract in 29 percent. Fundus details were not seen in 68 percent of the eyes.

The visual acuity was 20/200 or less in 63 percent of the eyes. No field was recorded for 75 percent of the eyes. An active process was present in 55 percent of the glaucomatous eyes. The acute process was of one or more months' duration in 55 percent of the eyes.

Of the eyes receiving medical treatment, 93 percent were of the acute type. Sixty-seven percent of the eyes under medical treatment had a good response, with 80 percent requiring a combination of mydriatics and miotics.

One or more surgical procedures were required in 79 percent of the eyes. The initial surgical procedure was an iridectomy in 30 percent of the eyes, a paracentesis or subconjunctival keratome incision into the anterior chamber in 26 percent, and an immediate enucleation in 14 percent.

The only complication was a late cataract in 15 percent of the operated eyes. In eyes without an acute process, an iridectomy was successful in 76 percent. If an acute process was present, a paracentesis or keratome incision controlled the tension in 93 percent of the eyes.

A late cataract developed in seven percent of the eyes with an acute process that was treated surgically. An immediate enucleation was required in 14 percent of the eyes, and ultimately 21 percent of the glaucomatous eyes were enucleated.

TABLE 2

SURGICAL PROCEDURES AND RESULTS IN GLAUCOMA SECONDARY TO IRITIS AND UVEITIS

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	8 100	4 50	— —	— —	4 50
Iridencleisis	2 100	1 50	— —	— —	1 50
Iridencleisis with anterior sclerectomy	1 100	1 100	— —	— —	— —
Iridectomy	17 100	13 76	— —	1 6	3 18
Cataract extraction	4 100	2 50	1 25	— —	1 25
Reese and paracentesis (all acute)	15 100	14 93	— —	1 7	— —
Transfixation	1 100	1 100	— —	— —	— —
Multiple	9 100	2 22	3 33	4 45	— —
Enucleation	10 100	— —	— —	— —	— —

In 50 percent of the patients, one eye was normal at the time of the glaucoma diagnosis. Bilateral glaucoma was present in 12 percent of the patients on the initial visit and glaucoma became bilateral in an additional four percent.

Hemorrhagic glaucoma

There were 24 patients with 33 glaucomatous eyes in this group. In 72 percent of these eyes the diagnosis was based on the histologic diagnosis after enucleation,

and in the remaining 28 percent on the presence of a new vascular membrane on the iris, vascular occlusion, or hemorrhage into the vitreous. This group contained two percent of all the glaucomatous eyes. The surgical procedures and results are tabulated in Table 3.

TABLE 3

SURGICAL PROCEDURES AND RESULTS IN HEMORRHAGIC GLAUCOMA

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	1 100	— —	— —	1 100	— —
Lagrange	1 100	— —	— —	1 100	— —
Cyclodiathermy	6 100	2 33	— —	3 55	1 12
Posterior sclerotomy	3 100	— —	— —	— —	3 100
Paracentesis	1 100	— —	— —	1 100	— —
Enucleation	18 100	— —	— —	— —	— —
Multiple	4 100	— —	— —	4 100	— —

SUMMARY

All of the eyes were followed one or more years; 67, two or more years. Ninety-one percent of the patients were 50 years of age or over. Females predominated (58 percent). Pain was the chief complaint in 90 percent. Gross corneal edema was present in 90 percent.

The anterior chamber was of normal depth in 55 percent and shallow in 24 percent. The iris contained new vessels in 64 percent of the eyes. The pupil was of normal size in 52 percent and large in 36 percent. There was an immature cataract in 36 percent and the lens was not seen in 39 percent. The fundus was not seen in 52 percent. Vascular occlusions were seen in 21 percent and hemorrhages in 18 percent. The visual acuity was less than 20/200 in all eyes. The tension was over 60 mm. Hg in 79 percent.

The treatment was medical in nine percent (all failures) and surgical in 91 percent. Of all the eyes subjected to surgery, only two responded successfully, both to cyclodiathermy. Immediate enucleation was performed in 52 percent of the eyes. Ultimately, 73 percent of the 33 eyes were enucleated.

Glaucoma was bilateral or developed in the second eye at a later date in 33 percent of the patients. In 54 percent of the patients one eye was free of glaucoma throughout the period followed.

HYPERMATURE LENS

There were 15 patients with 16 glaucomatous eyes in which the glaucoma was believed to be secondary to a hypermature lens. This group contained one percent of all the glaucomatous eyes. The surgical procedures and results are shown in Table 4.

TABLE 4

SURGICAL PROCEDURES AND RESULTS IN GLAUCOMA SECONDARY TO HYPERMATURE LENS

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Iridectomy	2 100	— —	— —	— —	2 100
Cyclodialysis	1 100	— —	— —	— —	1 100
Cataract extraction	9 100	6 67	— —	2 22	1 11
Enucleation	1 100	— —	— —	— —	— —
Multiple	4 100	— —	— —	4 100	— —

SUMMARY

All eyes were followed one or more years; 68 percent two or more years. Seventy-five percent of the patients were over 60 years of age. Fifty-six percent were female. The chief complaint was pain in 94 percent. The anterior chamber was shallow in 94 percent. The iris was normal in 50 percent and

atrophic in 44 percent. The pupil was large in 69 percent. The lens was hypermature in all eyes. The vision was light perception in 50 percent and questionable light projection in 31 percent. The tension was over 60 mm. Hg in 75 percent. Three eyes were blind.

The treatment was surgical in 81 percent of the eyes. All of the eyes receiving medical treatment had a poor result. A cataract extraction was the initial operation in 75 percent of the surgical cases with 67 percent good results. One eye, having an initial cataract extraction, was lost from severe uveitis. An enucleation was performed in 13 percent of the eyes.

In 81 percent of the patients one eye was normal, and in 19 percent the second eye was aphakic.

Capsular glaucoma

There were 29 patients with 47 glaucomatous eyes that had exfoliation of the lens capsule. This group contained four percent of all the glaucomatous eyes. In Table 5 are summarized the surgical procedures and results.

Summary

All glaucomatous eyes were followed one or more years: 70 percent, three or more years. Ninety-six percent of the patients were over 60 years of age. The male sex predominated slightly (55 percent). The chief complaint was poor vision in 85 percent of the patients.

In nearly all patients the glaucoma diagnosis was made by finding pathologic cupping of the nervehead during a routine fundus examination. The cornea was clear in 68 percent of the eyes. The anterior chamber was of normal depth in 51 percent and shallow in 40 percent. In 94 percent of the eyes the iris was normal.

In all eyes the aqueous was free of cells, but in several eyes pieces of lens capsule in the aqueous were noted with the slitlamp. The pupil was of medium size in 83 percent. In all patients exfoliation of the lens capsule was described.

There was pathologic cupping of the optic nerve in 74 percent of the eyes. There was a wide range of visual acuity, with 60 percent showing 20/100 or better. The tension was between 30 and 60 mm. Hg in 70 percent of the eyes. Seventy percent of the eyes showed glaucomatous field defects; 15 percent were normal; and in 15 percent no field was recorded.

Thirty percent of the eyes were treated medically and 70 percent had one or more operations. The response to medical treatment was good in 15 percent, fair in 21 percent, and poor in 64 percent. Moderate or intensive miotics were required in all eyes.

The response to the first surgical procedure was good in 61 percent of the eyes, with 15 percent being subjected to one or more operations. Of those having multiple surgery, 60 percent had a good result. The majority (60 percent) of the eyes had an initial trephination with 55 percent good results. An iridencleisis, with or without a sclerectomy, was performed in six eyes (18 percent) and all were successful.

TABLE 5

Surgical procedures and results in capsular glaucoma

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	20 100	11 55	3 15	2 10	4 20
Iridencleisis	3 100	3 100	— —	— —	— —
Iridencleisis with anterior sclerectomy	3 100	3 100	— —	— —	— —
Cataract extraction	6 100	3 50	2 33	1 17	— —
Paracentesis	1 100	— —	— —	— —	1 100
Multiple	5 100	3 60	— —	2 40	— —

The only complication was a late cataract in 35 percent of the trephining and 50 percent of the iridencleisis operations. One cannot draw accurate conclusions as to the choice of operation because there were not enough iridencleisis operations performed. The statistics suggest that an iris-inclusion operation controlled the tension better than a trephination, but the incidence of late cataracts was greater with iris-inclusion operations.

In 36 percent of the patients the glaucoma was bilateral, and in four percent one eye was blind from glaucoma.

Buphthalmos

There were 21 patients with 38 buphthalmic eyes. The patients were considered to have buphthalmos if the eye was large and glaucomatous, and/or if the glaucomatous process had begun within the first two years of life. No traumatic cases were included. This group contained four percent of all the glaucomatous eyes. The surgical procedures and results are recorded in Table 6. The only serious complication was an infection in an eye subjected to iridencleisis with an anterior sclerectomy, resulting in the loss of the eye.

TABLE 6

Surgical procedures and results in buphthalmos

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	13 100	3 23	— —	— —	10 77
Iridencleisis	14 100	1 7	2 14	3 21	8 58
Iridencleisis with anterior sclerotomy	7 100	2 29	— —	1 14	4 57
Posterior sclerotomy	1 100	— —	— —	1 100	— —
Reese	2 100	— —	— —	2 100	— —
Enucleation	1 100	— —	— —	— —	— —
Multiple	21 100	4 18	4 18	13 64	— —

Summary

The diagnosis was made by the time the child was six months old in 53 percent of the cases, and before two years of age in 87 percent. About 70 percent of the patients were males. In 79 percent, medical advice was sought because the eyes were large, and in 11 percent because the cornea was cloudy.

On examination, 87 percent of the eyes were grossly enlarged. The cornea was hazy or edematous in 95 percent of the eyes. The anterior chamber was deep in 63 percent, of normal depth in 30 percent, and shallow in seven percent. In none of the eyes were cells seen in the aqueous.

The iris was grossly normal in 92 percent. The pupil was of medium size in 82 percent. The lens was clear in 76 percent and was not seen in 18 percent. There was no description of the fundus in 82 percent of the eyes. Because they were infants, no vision was recorded in 92 percent. The first recorded tension was 40 mm. Hg or more in 94 percent of the eyes.

The treatment was ultimately surgical in all of the patients. The results were poor in most of the eyes. One or more operations were required in 63 percent of the eyes, and 60 percent of these eyes had a poor result regardless of the number of operations.

Although the series of operations is not large enough for definite conclusions, it appears that the iridencleisis with an anterior sclerectomy and trephination were about equally effective, with the former probably slightly more hopeful. Goniotomy was performed in no eyes of this series. This is not to be interpreted as an objection to this procedure. Only eight percent of the eyes required enucleation.

Glaucoma was present in both eyes of 86 percent of the patients.

Low-tension glaucoma

There were 11 patients with 18 glaucomatous eyes in which the tension was never recorded as being over 24 mm. Hg but which had pathologic cupping and some glaucomatous field direct. None of these patients were given a provocative test nor were any hospitalized for tension studies; therefore, it cannot be definitely stated that the tension was never over 24 mm. Hg. This group contained two percent of all the glaucomatous eyes.

Summary

All eyes were followed for one or more years, and 73 percent were followed three or more years. Eighty-four percent of the patients were aged 60 years or over. Seventy-two percent were females. It is important that 56 percent of the cases were discovered during a routine eye examination and the only complaint in the remaining 44 percent was poor vision.

The cornea was clear in all eyes. The anterior chamber was of normal depth in 56 percent and shallow in 44 percent. The aqueous was clear in all eyes. The iris was grossly normal in 89 percent. The pupil was of medium size in 83 percent. The lens was clear in 67 percent, and there was an immature cataract in 33 percent.

There was pathologic cupping in 94 percent of the eyes. The vision was 20/40 or better in 56 percent, and better than 20/100 in 89 percent of the eyes. The tension was less than 20 mg. Hg in 33 percent. All patients showed some glaucomatous field defect.

Treatment was medical in all but one eye, with good results in 28 percent and fair results in 65 percent. Moderate miotics were required to control the tension. The one operation, a cataract extraction, was not successful.

Glaucoma was bilateral in 64 percent of the patients at the time the diagnosis was made. One patient developed glaucoma in the second eye about 18 months later.

Although this group is small, it is extremely important because the patients had no complaints suggesting glaucoma and the tension was within what is considered the normal range. The diagnosis was made by finding pathologic cupping of the nervehead, supported by definite glaucomatous field defects. These eyes demonstrate the importance of recording the field in all patients with questionable cupping of the nervehead.

Acute primary glaucoma

There were 83 patients with 116 eyes that had acute primary glaucoma. This group was limited to those eyes with no history of a previous attack and with the clinical picture of acute primary glaucoma. This group contained 11 percent of all the glaucomatous eyes. The surgical procedures and results are tabulated in Table 7.

Summary

Sixty-seven percent of the eyes were followed three or more years. Eighty-four percent of the patients were over 50 years of age. Seventy-nine percent of the patients were female.

The chief complaint was pain in 97 percent of the patients. All eyes had gross corneal edema and all anterior chambers were shallow. The aqueous was clear in 97 percent of the eyes. The iris appeared grossly normal in 85 percent of the eyes. The pupil was large in 67 percent of the patients. The lens was clear in 53 percent, and was not seen in 30 percent, due to corneal edema. Fundus details were not seen in 82 percent of the eyes.

The vision was less than 20/200 in 83 percent of the eyes. The first recorded tension was 50 mm. Hg or more in 93 percent. No field was recorded for 85 percent of the eyes.

Surgical treatment was used in 97 per-

cent and medical treatment in three percent. In those eyes receiving only medical treatment, 75 percent had a good response.

An iridectomy was performed in 67 percent of the eyes treated surgically, with 79 percent good results. An iridencleisis with anterior sclerectomy was performed in 10 percent of the eyes with 82 percent good results. A late cataract developed in 32 percent of the eyes requiring a surgical procedure.

An immediate cataract developed in three percent of the eyes. One patient developed sympathetic ophthalmia following an iridencleisis with anterior sclerectomy. Reference is made to the table of surgery (Table 7) for a detailed break-down of operations and results. A statistical interpretation is difficult due to the small number of operations other than an iridectomy. Thirty-six percent of the eyes developing cataracts following glaucoma had a lens extraction, with a good result in 36 percent and a poor result in 57 percent.

TABLE 7

SURGICAL PROCEDURES AND RESULTS IN ACUTE PRIMARY GLAUCOMA

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	6	4	—	2	—
	100	67	—	33	—
Iridencleisis	7	4	1	1	1
	100	57	14	14	14
Iridencleisis with anterior sclerectomy	11	9	—	1	1
	100	82	—	9	9
Iridectomy	75	59	9	4	3
	100	79	12	4	4
Lagrange	5	4	—	—	1
	100	80	—	—	20
Cyclodialysis	1	1	—	—	—
	100	100	—	—	—
Posterior sclerotomy	1	—	—	—	1
	100	—	—	—	100
Paracentesis	1	—	—	—	1
	100	—	—	—	100
Cataract extraction	1	1	—	—	—
	100	100	—	—	—
Cyclodiathermy	2	—	—	1	1
	100	—	—	50	50
Enucleation	2	—	—	—	—
	100	—	—	—	—
Multiple	9	4	—	5	—
	100	44	—	56	—

Approximately 50 percent of the patients had one normal eye on admission and throughout the period followed; while the remaining 50 percent had glaucoma in both eyes on the first visit or developed glaucoma in the second eye at some later date.

CHRONIC CONGESTIVE AND RECURRENT ACUTE PRIMARY GLAUCOMA

There were 69 patients with 87 glaucomatous eyes in this group. The eyes in this group were of two types. The first type included those cases of what appeared to be chronic simple glaucoma in a congestive phase. The second type included eyes that apparently had had several previous congestive attacks which compensated without treatment. It was felt that the eyes in the second type had had repeated attacks of acute primary glaucoma but, due to peripheral anterior synechias, the disease process had become chronic in type. This group contained eight percent of all the glaucomatous eyes. The surgical procedures and results are shown in Table 8.

SUMMARY

Sixty-nine percent of the eyes were followed three or more years. In 79 percent the patients were 50 years of age or over; 70 percent were female. Pain was the chief complaint in 91 percent. Gross corneal edema was present in 90 percent. The anterior chamber was shallow in 92 percent and of normal depth in seven percent. The aqueous was clear in 98 percent.

The iris was grossly normal in 62 percent and atrophic in 23 percent. The pupil was of medium size in 56 percent and large in 49 percent. There was an immature cataract in 40 percent; the lens was clear in 36 per-

cent; and the lens was not seen in 22 percent.

There was pathologic cupping of the nervehead in 31 percent, and the fundus was not seen in 56 percent. The vision was 20/200 or less in 72 percent. The initial tension was 50 mm. Hg or over in 78 percent. A field examination was not recorded in 55 percent. Glaucomatous field defects were present in 29 percent, and 12 percent were normal.

Surgical treatment was employed in 80 percent and medical treatment in 20 percent. Of the eyes receiving medical treatment, 35 percent had a good response and 47 percent a poor response. The medication required to keep the tension at the lowest possible level was a moderate or intensive miotic in 94 percent. Thirty-six percent of the initial surgical procedures were trephinations, with 75 percent good results and 17 percent subjected to further surgery. Nineteen percent had an iridencleisis with anterior sclerectomy—65 percent were good results; 15 percent, failures; and eight percent, reoperated. Two eyes had an initial cataract extraction with one good result.

A late cataract developed in 42 percent of the trephinations; 38 percent of iridencleisis with anterior sclerectomies; and 46 percent of the iridectomies. A ruptured bleb followed one trephination. Forty-two percent of the late cataracts following glaucoma surgery were removed; 55 percent with good results; 27 percent with poor results.

One eye was normal throughout the period followed in 43 percent of the patients. Glaucoma was bilateral on the initial visit in 33 percent, and one eye was blind from glaucoma in seven percent. Glaucoma developed in the second eye in 15 percent.

Chronic simple glaucoma—shallow chamber

There were 149 patients with 258 eyes suffering from chronic, simple, shallow-chamber glaucoma. There was no history of a congestive phase in any eye. This group contained 23 percent of all the glaucomatous eyes. The surgical procedures and results are tabulated in Table 9.

TABLE 8

SURGICAL PROCEDURES AND RESULTS IN CHRONIC CONGESTIVE AND RECURRENT ACUTE PRIMARY GLAUCOMA

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	24 100	18 75	2 8	— —	4 17
Iridencleisis	7 100	5 71	— —	— —	2 29
Iridencleisis with anterior sclerectomy	13 100	9 69	1 8	2 15	1 8
Iridectomy	13 100	5 39	2 15	2 15	4 31
Lagrange	5 100	2 40	— —	2 40	1 20
Cyclodialysis	1 100	1 100	— —	— —	— —
Posterior sclerotomy	1 100	— —	— —	1 100	— —
Cyclodiathermy	1 100	— —	— —	— —	1 100
Cataract extraction	2 100	1 50	— —	1 50	— —
Enucleation	3 100	— —	— —	— —	— —
Multiple	13 100	8 62	1 8	4 30	— —

Summary

Seventy-one percent of the eyes were followed three or more years. Seventy percent of the patients were aged 60 years or over; 58 percent of the patients were female.

The chief complaint was poor vision in 74 percent of the eyes. Eighteen percent of the glaucomatous eyes were discovered during a routine examination. The cornea was clear in 75 percent of the eyes. The anterior chamber was shallow and the aqueous free of cells in all eyes.

The iris appeared grossly normal in 85 percent. The pupil was of medium size in

TABLE 9

SURGICAL PROCEDURES AND RESULTS IN CHRONIC SIMPLE GLAUCOMA—SHALLOW CHAMBER

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	100 100	72 72	10 10	8 8	10 10
Iridencleisis	18 100	9 50	5 28	1 6	3 16
Iridencleisis with anterior sclerectomy	18 100	9 50	3 17	3 17	3 17
Iridectomy	8 100	3 38	1 13	— —	4 50
Lagrange	1 100	1 100	— —	— —	— —
Cyclodialysis	4 100	3 75	1 25	— —	— —
Cataract extraction	5 100	2 40	— —	3 60	— —
Enucleation	4 100	— —	— —	— —	— —
Multiple	20 100	6 30	3 15	11 55	— —

85 percent. The lens was clear in 53 percent, and an immature cataract was present in 43 percent. Pathologic cupping of the disc was observed in 76 percent.

The visual acuity was 20/50 or better in 56 percent. Six percent of the eyes were blind. The tension was 40 mm. Hg or over in 65 percent. Glaucomatous field defects were present in 75 percent of the eyes. No field was recorded in 12 percent.

Treatment was surgical in 61 percent and medical in 39 percent. Of the patients receiving medical treatment, 25 percent had a good response and 40 percent were failures. Moderate or intensive miotics were required in 98 percent.

Sixty-five percent of the eyes treated surgically had an initial trephination with 72 percent obtaining a good result. An iridencleisis was performed in 12 percent with 50 percent good results. An iridencleisis with anterior sclerectomy was performed in 12 percent with 50 percent good results. An iridectomy was performed in five percent with a good result in 38 percent. A late cataract developed in 48 percent of the eyes on which a trephination was done, 44 percent of the eyes with an iridencleisis, 22 percent of the eyes with an iridencleisis and anterior sclerectomy, and 38 percent of the eyes with an iridectomy. One eye with a trephination developed a late infection, and one eye with an iridectomy had an expulsive hemorrhage.

A trephination controlled the tension best; however, the incidence of late cataracts was highest in this group. An iridencleisis with anterior sclerectomy, while having the lowest incidence of late cataracts, did not have as high a percentage of controlled tension. In the eyes that had a cataract extraction following glaucoma surgery, 33 percent had no recurrence of glaucoma, while in 67 percent glaucoma returned. Enucleation was performed in three percent of the glaucomatous eyes.

Glaucoma was bilateral in 56 percent of the patients on the initial visit. Three percent developed glaucoma in the second eye during the period followed. Eighteen percent were blind of glaucoma in one eye at the time of the initial diagnosis of glaucoma. Nineteen percent of the patients had one normal eye throughout the period followed.

CHRONIC SIMPLE GLAUCOMA—NORMAL OR DEEP CHAMBER

There were 200 patients with 339 glaucomatous eyes with a normal or deep anterior chamber and no history of a congestive phase of glaucoma. This group contained 31 percent of all the glaucomatous eyes. Table 10 shows the surgical procedures and results.

SUMMARY

Seventy-nine percent of the eyes were followed three or more years; 87 percent of the patients were 50 years of age or over; 60 percent of the patients were male.

The chief complaint was poor vision in 68 percent of the eyes, and 24 percent of the cases were discovered during a routine examination. The cornea was clear in 90 per-

cent of the eyes. The anterior chamber was of normal depth in 97 percent and deep in three percent.

The iris was grossly normal in 92 percent. The pupil was of medium size in 84 percent. The lens was clear in 62 percent, and an immature cataract was present in 36 percent. Pathologic cupping of the optic nerve was present in 80 percent.

The visual acuity was 20/50 or better in 61 percent of the eyes, while four percent were blind. The initial tension was between 30 and 39 mm. Hg in 42 percent, and 40 mm. Hg or over in 52 percent. Glaucomatous field defects were present in 74 percent of the eyes. Fields were normal in 15 percent and not recorded in seven percent.

The treatment was medical in 49 percent and surgical in 51 percent. Of those receiving medical treatment, 29 percent had a good response and 39 percent were failures. Moderate or intensive miotics were required in 97 percent of the eyes to keep the tension at the lowest level.

A trephination was performed in 73 percent of the operated eyes, with 73 percent having a good result and 12 percent requiring further surgical procedures. An iridencleisis was performed in seven percent, with 54 percent good results and eight percent requiring a second operation. An iridencleisis with anterior sclerectomy was performed in 10 percent, with 83 percent good results and no eyes having a second operation. Five eyes were subjected to an initial cataract extraction and no glaucoma procedure with a good result in 40 percent, a fair result in 40 percent, and a poor result in 20 percent. Other surgical procedures were too few for conclusion.

There was a late infection in five percent of the trephinations. An immediate cataract developed in two percent of the trephinations and 11 percent of the iridencleises with anterior sclerectomy. A late cataract developed in 39 percent following a trephination, 31 percent with an iridencleisis, and 39 percent with an iridencleisis with anterior sclerectomy.

TABLE 10

SURGICAL PROCEDURES AND RESULTS IN CHRONIC SIMPLE GLAUCOMA—NORMAL OR DEEP CHAMBER

Operation	Total	Result			Multiple Surgery
		Good	Fair	Poor	
Trephination	128 100	94 73	11 9	8 6	15 11
Iridencleisis	13 100	7 54	3 23	2 15	1 8
Iridencleisis with anterior sclerectomy	18 100	15 83	3 17	— —	— —
Iridectomy	2 100	— —	— —	1 50	1 50
Cyclodialysis	4 100	4 100	— —	— —	— —
Posterior sclerotomy	1 100	— —	— —	— —	1 100
Cataract extraction	5 100	2 40	2 40	1 40	— —
Enucleation	3 100	— —	— —	— —	— —
Multiple	18 100	7 39	3 17	8 44	— —

Sympathetic ophthalmia developed after one trephination and one iridencleisis with anterior sclerectomy. There was one ruptured trephination bleb and one expulsive hemorrhage.

Although the most frequent operation was trephination, the best results appeared to be following an iridencleisis with anterior sclerectomy. Eighteen cataracts, developing after a glaucoma operation, were removed with 56 percent obtaining a good result in so far as glaucoma was concerned. Three percent of the glaucomatous eyes were enucleated.

Nineteen percent of the patients had one normal eye throughout the period followed; 59 percent had glaucoma in both eyes on the initial visit. Eighteen percent were blind from glaucoma in one eye on the initial visit.

GENERAL ANALYSIS

There were 816 patients with 1,112 glaucomatous eyes subjected to detailed statistical

study. The following general statistics would not have been appreciably altered had all of the glaucomatous eyes (approximately 3,500) been included.

Approximately 85 percent of the patients were over 45 years of age, and 70 percent of the eyes were observed for three or more years.

Seventy percent of the eyes showed no evidence of congestion at the time glaucoma was recognized, while the remaining 30 percent had moderate or marked congestion.

In noncongestive glaucoma, 51 percent of the patients were male and 49 percent were female. In congestive glaucoma, 70 percent of the patients were female and 30 percent were male.

Sixty percent of the patients sought medical advice for poor vision or a routine examination, and 33 percent because of pain or a red eye.

The anterior chamber was shallow and the cornea edematous in 50 percent of the eyes.

The iris was normal in 75 percent of the eyes, and there was gross iris atrophy in 10 percent.

In the eyes with congestive glaucoma, 55 percent had a dilated pupil; while in noncongestive glaucoma, 85 percent had a medium-size pupil. If all eyes are grouped together, 70 percent had a medium-sized pupil, 16 percent a large pupil, and 14 percent a small pupil.

Pathologic cupping of the optic nerve was seen in 50 percent of the eyes and the fundus was not seen in 35 percent.

There was a glaucomatous defect in 47 percent, and the field was normal in 11 percent. No field was recorded for 42 percent of the eyes. Of the eyes with a recorded field, approximately 90 percent had some type of glaucomatous field defect.

The first recorded tension was 40 mm. Hg or over in 70 percent of the eyes.

Sixty-seven percent of the eyes were subjected to some type of surgery, while 33 percent were treated medically.

On the basis of this study, the following general impressions appear to be justified:

If the patient is suffering from acute congestive glaucoma, immediate intensive medical therapy should be instituted. If possible, surgery is to be avoided until the tension is lowered and the congestion has decreased.

The two most important factors determining the need of immediate surgical intervention are the central vision and peripheral field. If the loss of central vision is rapid with constriction of the field and the tension remains elevated, surgery cannot be delayed.

The choice of operation will depend upon the type of glaucoma and the condition of the eye. In general, a paracentesis or subconjunctival keratome incision into the anterior chamber should not be performed unless the surgeon is reasonably certain no other surgical procedure will be needed.

If the patient has noncongestive glaucoma or has responded well to medical treatment during an acute attack of congestive glaucoma, the long-term plan of treatment must be determined. Probably the most important factor in this decision is the patient's age and general health.

If the patient's life expectancy is 15 or more years, surgery must be seriously considered. It is an exceptional glaucomatous eye that will not suffer significant damage over a period of 15 or more years on medical treatment alone. In general, glaucomatous eyes in patients under 50 years of age should have surgery once the diagnosis is established. After the age of 65 years, conservative treatment is recommended.

Most patients over 65 years of age have lens changes that usually become appreciably worse following glaucoma surgery. In this age group one should be content with a slow loss of field and moderate elevation of tension unless the glaucoma damage is very marked. If operated, a large number of these patients will become blind from the resultant cataract.

The greatest problem is the proper treatment in the age group from 50 to 65 years. In this age group one must decide if surgery is indicated by the extent of the damage on the initial visit, whether the process is bilat-

eral, the condition of the lens, the response to miotics, and the life expectancy. It is most important to follow the fields carefully in all patients who are on medical treatment.

Choice of operation

The choice of the operation for the various types of glaucoma varies greatly among surgeons. The following impressions are based on the findings in this study of cases in which the surgery was performed by many surgeons:

Iridectomy. An iridectomy was most successful in acute primary glaucoma, provided it was done during or following the first attack. An iridencleisis with anterior sclerectomy was equally successful in acute primary glaucoma.

Cyclodialysis. A cyclodialysis was the most successful operation in aphakic glaucoma. Although the operation was performed in only seven eyes with chronic simple glaucoma, the results were very good, especially when the anterior chamber was of normal depth. If performed in chronic simple glaucoma, it should be limited to those eyes with only a moderate elevation in tension.

Trephination. In this study a trephination was the most frequent filtration operation. A trephination was most successful in chronic simple glaucoma with a shallow chamber, and in recurrent primary and chronic congestive glaucoma. In chronic simple glaucoma with a normal or deep chamber, an iridencleisis with anterior sclerectomy was slightly better. In the hands of inexperienced surgeons, a trephination appeared to be the most successful filtration operation.

In the younger age group, the trephination is more satisfactory. If there is much elevation of tension at the time of surgery, a trephination is contraindicated because there is a tendency for the lens to herniate into the trephine hole.

Iris inclusion. An iris-inclusion operation was most successful in chronic simple glaucoma with a normal or deep chamber and capsular glaucoma. The results were better when a sclerectomy was performed with the iris inclusion. In the presence of iris atrophy, new vessels on the iris, and diabetic iritis, an iris-inclusion operation is contraindicated.

Although there appears to be some difference in the results of a trephination and iris-inclusion operation, this may be explained by the techniques of the different surgeons, except in the case of capsular glaucoma. This probably explains the reason for the contradictory reports in the literature concerning these two operations.

A paracentesis or subconjunctival keratome incision into the anterior chamber should be limited to eyes with glaucoma secondary to iritis and uveitis. Rarely will these procedures alone control the tension, except in this type of glaucoma, if surgical intervention is indicated. In several eyes the condition was complicated because these procedures were performed first. In these eyes the second operation was made more difficult due to a flat anterior chamber and congested eye.

Complications

There were 735 initial glaucoma operations. In these 735 operations, 28 percent developed a late cataract and one percent developed an immediate cataract. An expulsive hemorrhage occurred in 0.4 percent and sympathetic ophthalmia in 0.4 percent. There was an immediate infection in 0.1 percent and a late infection in 1.0 percent.

One of the most controversial subjects is the development of late cataracts in trephining operations as compared to iris-inclusion operations. The following data are based on the development of late cataracts in the same age groups following the above operations:

There were 217 trephining operations in patients over the age of 50 years. The age distribution was 63 (29 percent) between 50 and 59 years; 85 (39 percent), 60 and 69 years; and 79 (33 percent), 70 years and over. Before surgery, the lens was clear in 112 (50 percent); there was an immature cataract in 85 (39 percent); and exfoliation of the lens capsule in 20 (11 percent). A

late cataract developed in 104 (46 percent) of the operated eyes.

There were 44 iridencleisis operations in patients over the age of 50 years. The age distribution was six (13 percent) between 50 and 59 years; 19 (43.5 percent), 60 and 69 years; and 19 (43.5 percent), 70 years and over. Before surgery the lens was clear in 17 (39 percent); there was an immature cataract in 24 (55 percent); and exfoliation of the lens capsule in three (seven percent). A late cataract developed in 19 (43 percent).

There were 50 iridencleisis with anterior sclerectomy operations in patients over the age of 50 years. The age distribution was 14 (28 percent) between 50 and 59 years; 19 (38 percent), 60 and 69 years; and 17 (34 percent), 70 years and over. Before surgery, the lens was clear in 25 (50 percent); there was an immature cataract in 22 (44 percent); and exfoliation of the lens capsule in three (six percent). A late cataract developed in 20 (40 percent).

There was no significant difference in the development of late cataracts in the three types of surgery.

Medical treatment

The long-term results from medical treatment of glaucoma are discouraging. It is essential that all glaucoma patients being treated medically be kept under close supervision. Repeated fields must be performed if blindness is to be avoided, because many patients lost an appreciable portion of their field despite apparent control under miotics. Moderate miotics were required in most of the eyes. In eyes under miotic therapy, with small pupils and some elevation of tension, the addition of adrenalin drops frequently reduced the tension. In aphakic glaucoma, a combination of adrenalin and miotics was superior to either type of medication alone.

Glaucoma programs

The most important part of any statistical study is the practical application of the collected data. This section is devoted to general plans that, on the basis of this study, appear to be essential in the proper handling of glaucoma patients. The following plans are the results of reviewing the 2,500 case histories, my experiences at the Massachusetts Eye and Ear Infirmary, and the questioning of the staff members and residents from this and other large clinics in this country.

Clinic patients

In a large clinic it is impossible to devise any certain method for making the initial diagnosis of glaucoma. By necessity, in large clinics, both new and old patients will be seen by one of many staff men or residents. Some of these men will not be interested in the glaucoma problem, while the younger residents may lack experience. As a result, some cases will be incorrectly diagnosed. It was evident in this study that, even in an organized eye clinic, stress must be placed on a complete examination of the patient, regardless of the complaints, if the number of these errors in diagnosis are to be reduced to a minimum. In order to accomplish this, a planned educational program is probably the best approach.

Regular reports from a glaucoma committee would be the most desirable educational method. Such reports could be made 3 or 4 times each year at a joint meeting of the visiting and resident staffs of the clinic. This report should be impersonal and merely state that, during the previous period, an incorrect diagnosis had been made in so many patients before glaucoma was recognized. Perhaps it would be well to include the probable reasons for the initial error in diagnosis. At this same meeting, papers related to the diagnosis and treatment of glaucoma would complete a useful ophthalmic program. I feel that a plan such as this would stimulate interest in glaucoma and all would benefit, especially the patients.

In clinics with a sufficiently large resident staff, routine fields on patients over 45 years of age would be helpful. This suggestion, however, would not be practical in most institutions. So many patients in this age group are examined in clinics that routine

fields, even if limited to new patients, would be practically impossible. Therefore, it is important that all men working in clinics take a careful history and do a detailed examination in the older age group.

Once the diagnosis of glaucoma has been made, a definite program is essential for the proper care of the patient. A well-formulated program will also aid in the training of the residents.

A sound glaucoma program should be divided into two parts: (1) The medical and surgical care, and (2) the social-service supervision of the patient.

Medical and surgical care

First to be considered is the medical and surgical care, especially in the out-patient department. I believe that all glaucoma patients should be seen in a group separate from the other clinic patients. This could be handled in one of two ways.

If the out-patient department functions on the basis of a different service each day (the system used at the Massachusetts Eye and Ear Infirmary) it would be best to have one staff man and one or more residents see all of the glaucoma patients as a separate group each day. The selection of a staff man interested in glaucoma would be important. The staff men could be rotated at regular intervals. In other clinics it may be better to have all glaucoma patients report on one or two days of each week.

If glaucoma patients were seen as a separate group, they would receive better care because they would be seen by men interested and trained in the treatment of glaucoma. This system would be valuable to the resident staff because better instruction in the diagnosis and treatment of glaucoma would be possible. Each resident would examine and follow more patients under such an arrangement. By rotating the staff men and services, the residents would be exposed to varied methods of diagnosis and treatment.

If the patients had tensions and fields recorded before being examined in the glaucoma clinic, the time involved in examining and prescribing for the patients would not exceed one to two hours each clinic period, even in a large clinic. The men examining the glaucoma cases could then treat other types of clinical diseases during the remainder of the clinic period.

Before the patients are seen by the staff men and resident, the following procedures should be done:

1. Tension. All patients should have the tension taken with a tonometer and the pressure should be recorded on each visit. In patients on miotic therapy there should be a note made as to when the drops were last used before taking the tension. The tension may be recorded on a graph or in the clinic note. The use of a tension sheet in graph form is the most desirable method because at a single glance, it is possible to observe the tension fluctuations from time to time. If recorded with the clinic notes, one must search through numerous sheets to determine the course of the patient's tension.

2. Visual acuity. The visual acuity should be recorded on each visit. Subjectively, many patients do not realize they are losing vision until they are nearly blind.

3. Fields. Fields are the most important criteria in following glaucoma patients. In reviewing these cases, it was evident that, because fields were neglected, many patients lost a great deal of their peripheral and/or central field of vision before vigorous treatment was instituted. In spite of apparently well-controlled tensions, some patients continued to lose fields until a relative hypotony was produced by surgery.

Since glaucoma patients lose field without other signs, I believe that all such patients, especially those under miotic therapy, should have a field examination on each visit or, if this is impossible, at least three times a year. These fields can be done rapidly, serving merely as a check to see if there has been any appreciable change. Those patients who have had surgery and have hypotony need not have routine fields because nothing can be done to prevent further loss.

4. Notes. Each time the patient is seen, a brief note of any subjective or objective change should be written down. Above all, on each visit the treatment to be used during the next few weeks or months should be recorded. If this information is not in the record, a later examiner will be unable to determine which drug has controlled or failed to control the tension.

The last, and most important, consideration for the patient is intelligent reviewing of the case histories. In this study it was evident that in too many patients the disease was allowed to progress too far before surgery was undertaken. It was also evident that early surgery was usually more successful. Of course, the decision for surgery will depend upon the individual surgeon's opinion. The important point to be stressed is that the individual patient should not become lost in the mass of clinic patients and allowed to become almost blind before something is done. The only way to prevent this tragedy is by diligent checking of the patient and the course of the disease on each clinic visit and to make an early decision as to whether surgery will be required.

Once the decision has been made that surgery is indicated, the type will depend upon the individual surgeon. In the statistical portion of this paper the types of surgery and results are reviewed.

Social service supervision

The second part of the glaucoma program in a clinic concerns the supervision of the patients by social service. This portion of a glaucoma program is essential if an adequate follow-up is to be expected. In a clinic the patient's time with the physician is quite limited and, as a result, instructions are frequently inadequate. Due to inadequate instructions, many patients with glaucoma will drift away from medical care unless some one is responsible for checking on them. This function is well handled by social service; and, if possible, all clinics should have a social-service worker for glaucoma patients.

All new patients should be referred to social service for an interview. This interview should be used to obtain data, such as the patient's address, occupation, obligations, and so forth. A trained social-service worker can frequently explain the importance of return visits to the clinic, the general nature of the disease, and other details to the lay person better than his physician.

The social-service worker should see that all patients have an appointment before they leave the clinic. She should also see that each patient has sufficient medication and understands the frequency of administration. She should explain to the patient that, in the event the medication is spilled or insufficient, he should contact her for refills. This supervision of the patient can be adequately handled by nonmedical personnel.

The social worker should also keep a record of all glaucoma patients who have appointments each day. If the patient fails to keep an appointment, the social worker should contact him by mail or telephone to make a new appointment. When the patient still refuses to keep the appointment, sending him a form letter often brings him back.

In these letters it should be stated that no further responsibility for the patient's care can be assumed by the clinic unless the patient coöperates. A duplicate of this letter should be in the patient's record. In this manner, some patients will grasp the gravity of the situation and return again for care; while those failing to return cannot accuse anyone at the clinic of negligence.

Private patients

In the care of glaucoma patients in private practice, two recommendations can be made on the basis of this study. In the first place, routine examination of fields in patients over the age of 45 years cannot be stressed too much. Many early cases of glaucoma will be discovered by this procedure.

The second recommendation is an organized attempt to keep glaucoma patients under medical supervision. This can best be handled

by giving the patient an appointment for his next visit at the completion of each examination. A few days before the appointment, cards mailed to the patient to remind him of the time and date of the coming appointment will be helpful. If a patient does not keep his appointment, he should be contacted by mail or telephone to determine the reason. If the patient does not coöperate and fails to keep keep 2 or 3 appointments without sufficient reason, the physician should write him a letter, a carbon copy of which should be placed in the patient's record.

In this letter the patient should be advised that the physician no longer assumes the responsibility for the treatment of the patient's glaucoma. Although this may appear to be unnecessary, I believe that it is a duty of the physician; and, in most cases, it will benefit the physician because he cannot be accused of allowing a patient to become blind through his negligence.

Conclusions

The most important finding in this study was the need for greater emphasis on the early diagnosis of glaucoma. This was evident when one considered the large number of patients, many being treated by physicians or optometrists for visual complaints, who had progressed to an advanced stage of the disease before glaucoma was recognized. This problem becomes increasingly important if one considers the present life expectancy with the resultant increase in individuals of the glaucoma age group. It is the duty of the ophthalmologist to develop an awareness of this problem.

Approximately 85 percent of the patients were over the age of 45 years, and 60 percent of the chief complaints were those commonly associated with presbyopia. In a majority of the patients, a refraction relieved the patient's complaints, with glaucoma being discovered during the routine ophthalmic examination.

Two thirds of the glaucomatous eyes were not congested. This fact needs to be stressed in the teaching of medical students and to those individuals treating ocular complaints. For several months I have been asking medical students and residents (other than ophthalmic) what would be the chief complaint and physical findings of the majority of patients with glaucoma. Nearly all have replied pain and a red eye, which are complaints present in only one third of these patients.

In noncongestive glaucoma, the sex distribution was equal. The most valuable routine test for this type of glaucoma is a field examination, because a defect was present at the time of the initial field in nearly 90 percent of the glaucomatous eyes. Glaucomatous cupping was seen in 60 percent. Approximately 50 percent had a shallow anterior chamber, with gross corneal edema present in 40 percent.

Seventy percent of the patients with congestive glaucoma were women. In this type of glaucoma the most valuable diagnostic finding, other than congestion, was corneal edema which was present in nearly 100 percent of the eyes. The anterior chamber was shallow in 85 percent.

The first recorded tension (Schiøtz) was 40 mm. Hg or more in 70 percent of all the glaucomatous eyes.

One of the most important factors in treating glaucoma patients is the age of the patient and the life expectancy. If the patient is less than 50 years of age with a life expectancy of 15 or more years, surgery should be performed as soon as the glaucoma diagnosis is established. After the age of 65 years, conservative therapy should be stressed. In the group between the ages of 50 and 65 years, each individual case must be judged by evaluating the various factors concerned.

Treatment

Conservative therapy under close supervision should be stressed, because a significant percent of the operated eyes will be surgical failures or have some complication.

The decision concerning surgery should be made early so that there will be a minimum of permanent damage to the eye.

The treatment will be discussed under the types of glaucoma.

Tumor. The important observations in this type were that in 50 percent of these eyes a tumor was not suspected and that all patients had advanced unilateral glaucoma. This supports the opinion that all blind glaucomatous eyes, especially those in which fundus details are not seen, should be enucleated.

Aphakia. Seventy percent of the eyes with aphakic glaucoma had some complication during or following the cataract extraction. The most important complication was vitreous loss. Medical treatment was moderately successful, with a majority of the eyes responding best to a combination of a miotic and adrenalin. The most successful surgical procedure was a cyclodialysis.

Iritis and uveitis. The distribution of eyes between acute and quiet iritis and uveitis was approximately equal. Fifty percent of the acute type were treated medically, with 80 percent good results. In the acute type, a paracentesis or subconjunctival keratome incision into the anterior chamber controlled the tension in 80 percent of the eyes, if surgery was indicated. In glaucoma that was secondary to old iritis or uveitis, surgery was required in all but one eye. An iridectomy was performed in one-half of the eyes treated surgically, with 76 percent good results.

Hemorrhagic. Seventy-three percent of the eyes with hemorrhagic glaucoma were ultimately enucleated. The only successful treatment, other than enucleation, was cyclodiathermy in two of the six eyes treated in this manner.

Hypermature lens. Twenty percent of the eyes with glaucoma secondary to a hypermature lens were treated medically with poor results in all eyes. An initial cataract extraction with a broad basal iridectomy was performed in 70 percent of the eyes treated surgically, with 67 percent having a good result.

Capsular. Thirty percent of the eyes with capsular glaucoma were treated medically with 15 percent good results. Approximately 60 percent of the eyes treated surgically had a trephination, with 55 percent obtaining a good result. Only 18 percent of the eyes treated surgically had an iris-inclusion operation but all were successful.

Buphthalmos. All buphthalmic eyes were subjected to surgery. A trephination was successful in 23 percent of the eyes, while an iridencleisis with anterior sclerectomy was successful in 28 percent.

Low tension. Ninety-four percent of eyes with low-tension glaucoma were treated medically. There was a good response to medical treatment in 28 percent, a fair response in 65 percent, and a poor response in seven percent.

Acute primary. Three percent of these eyes were treated medically, with 75 percent having a good result. Seventy percent of the eyes subjected to surgery had an iridectomy, with 79 percent obtaining a good result. An iridencleisis with anterior sclerectomy was performed in 10 percent of the eyes with 82 percent good results.

Chronic congestive or recurrent primary. Medical treatment was used in 20 percent of these eyes with a good response in 35 percent, a fair response in 18 percent, and a poor response in 47 percent. Of the eyes treated surgically, 36 percent had a trephination, with 75 percent obtaining a good result. An iris-inclusion operation was performed in 30 percent, with good results in 70 percent of the eyes. An iridectomy was performed in 19 percent of the eyes, with 38-percent good results.

Chronic simple, shallow chamber. Thirty-nine percent of these eyes were treated medically with a good response in 25 percent, a fair response in 35 percent, and a poor response in 40 percent. A trephination was performed in approximately 70 percent of

the eyes which underwent surgical treatment. A good result was obtained in 72 percent of the trephined eyes. A cyclodialysis was performed on four eyes with three good results.

Chronic simple, normal, or deep chamber. Approximately one half of these eyes were treated medically. Under medical therapy, 30 percent had a good response. In the eyes treated surgically, an iris-inclusion operation produced the best results. Eighty-three percent of the iris-inclusion operations were successful. The most frequent operation was a trephination. Seventy-three percent of the eyes in which a trephination was done had a good result. A cyclodialysis was performed on four eyes with a moderate elevation in tension, all showed a good result.

There was a total of 735 initial surgical procedures for glaucoma. A late cataract developed in 28 percent of the eyes. The development of a late cataract did not appear to be related to the type of surgery. An immediate cataract developed in 1.0 percent of the eyes. There was an expulsive hemorrhage during or following surgery in 0.4 percent. Sympathetic ophthalmia developed in 0.4 percent. There was an immediate infection in 0.1 percent, and a late infection in 1.0 percent of the eyes with surgical procedures.

Approximately five percent of the patients were blind from glaucoma in one eye before the disease was recognized.

It is recommended that all glaucoma patients in a clinic be seen as a separate group. For an adequate follow-up of clinic patients, an organized social service department is essential. The use of form letters for patients who do not coöperate in keeping appointments is helpful.

Glaucomatous patients under medical treatment should be examined at least 3 or 4 times each year. On each visit the tension should be measured with a tonometer, the visual acuity should be recorded, and fields of vision should be tested.

411 Alameda Road (2).

THE PROBLEM OF GLAUCOMA

HERMAN ELWYN, M.D.
New York

I

Sir Stewart Duke-Elder, in a recent address in Chicago on "The dependence of surgery on physiology,"[1] discussed certain fundamental concepts of glaucoma. In an attempt to analyze pathogenetic factors in glaucoma, this address does not really clarify them, and perhaps tends to confuse. The eminence of the author, who has devoted so much of his life's work to the problems of glaucoma, guarantees a rapid diffusion of his ideas among ophthalmologists. Because of his eminence and great authority, the ideas presented definitely warrant a discussion. Any criticism could not possibly detract from his great achievement in this field.

The following critical discussion takes it starting point from the thesis presented by me in 1938[2] and restated in 1947.[3] According to this thesis, primary glaucoma is the result of an inherited inherent defect in the central mechanism integrating and regulating the individual factors which maintain the tension within the eye at a normal value.

Duke-Elder, in his *Textbook of Ophthalmology* (volume 3, pages 3356 and 3362) takes cognizance of this concept but does not pay any further attention to it. He adds on the subject of the regulation of physiologic values that "this is a conception of vital significance about which physiologists have as yet little knowledge." While such knowledge is still defective, progress is being made as shown by the work of Prof. W. R. Hess.[4]

My conception of glaucoma is summarized (1947) as follows:

1. It is a heredoconstitutional functional disease, involving primarily the function of central regulation of the intraocular pressure.

2. In some persons, as a result of inherited influences, at about middle age or earlier the central regulation becomes unstable. Impulses from the center reach the effector organ in the eye in normal numbers at times and in smaller numbers at others.

3. As a result, the chemical mediator, acetylcholine, is produced in an irregular manner at the nerve endings in the effector organ, and the action of this organ is irregular. The intraocular pressure is normal at times and high at others.

4. The normal intraocular pressure is maintained by the constant volume of the aqueous in the chambers of the eye and by the constant volume of blood in the choroidal vessels. These constant volumes are maintained by the activity of the units of the effector organ in the eye.

5. The effector organ for maintenance of the normal intraocular pressure consists of three units: The ciliary body and the angle of the anterior chamber with its venous system, which maintain the constant volume of aqueous, and the choroidal vessels, which maintain a constant volume of blood in the choroid.

6. When insufficient impulses from the central regulation reach the units of the effector organ, either the constant volume of the aqueous is increased or the constant volume of the blood in the choroidal vessels is increased, or both are increased.

7. Primary glaucoma is one disease only. It either manifests itself by an insidious onset and a slowly progressive course—chronic simple glaucoma—or the course is at times interrupted by a sudden, intense increase in the intraocular pressure, which produces severe symptoms, characterized as acute congestive glaucoma, or milder symptoms, characterized as a prodromal attack of acute glaucoma.

8. Secondary glaucoma is the increase in the intraocular pressure which results when the outflow of aqueous from the chambers of the eye or the constant volume of blood in the vessels of the choroid is interfered with by organic changes within the eye.

To this I now add:

9. Primary glaucoma is a strictly functional disease in the early stages, due to the irregular and insufficient production of the chemical mediator, acetylcholine.

10. Primary glaucoma ceases to have a strictly functional character when organic changes have been produced in the angle of the chamber by the increased pressure.

11. Acetylcholine being the chemical mediator of the parasympathetic nerve fibers, it is obvious that the maintenance of the normal intraocular pressure is under the control of the parasympathetic nervous system. There is so far no evidence that the sympathetic fibers with their chemical mediator, adrenalin, exert any influence in the control of the intraocular pressure.

12. So long as primary glaucoma is strictly functional in character, it has two methods of treatment: (1) The replacement of acetylcholine by drugs which have the muscarinic action of acetylcholine; (2) the use of drugs which inhibit cholinesterase and thus prevent the destruction of acetylcholine. So far no other drugs have been found effective in the treatment of glaucoma in its functional stage. All of the drugs of the above two categories are always efficacious in the strictly functional stage of primary glaucoma. Their efficacy here is evidence that the intraocular pressure is under parasympathetic control, and that it is the loss of this control which causes the increase and the irregularities in the intraocular pressure in the functional stage of glaucoma.

13. The addition of organic changes, especially in the angle of the anterior chamber, converts the strictly functional character of primary glaucoma into an organic-morphologic one. Only now does the question of surgical intervention arise.

II

Duke-Elder begins his discussion by mildly disparaging the ideas held by ophthalmologists for half a century "that the essential feature of glaucoma was raised tension; its immediate local cause an embarrassment of drainage; and its adequate treatment, a measure of drugs or operation to improve the drainage." This in spite of the fact "that there were voices crying in the wilderness." Instead he submits "that a raised tension is merely a complication occurring in a more fundamental disease—or, more accurately in a congeries of disease conditions."

An increase in ocular tension is, of course, a complication in the diseases causing secondary glaucoma when the outflow of aqueous from the chambers of the eye or the constant volume of blood in the vessels of the uvea is interfered with by organic changes within the eye.

In primary glaucoma during the varying periods of strictly functional change, there is no such interference, and the use of drugs is not to improve drainage but to supply a substitute for the chemical mediator, acetylcholine.

If by the submission just quoted, Duke-Elder means to imply that there is no primary glaucoma, there is against him the observations of early strictly functional stages of glaucoma with the absence of any organic changes within the eye.

Duke-Elder rightly discards the division into narrow-angle and wide-angle glaucoma, which, while clinically allowable, has no fundamental significance. However, he keeps to the division of glaucoma into congestive and noncongestive which he thinks has a fundamental significance. From the practical standpoint of clinical observation, such a distinction is permissible, but as to having fundamental importance it is not acceptable.

III

Acute congestive glaucoma

The normal intraocular pressure is maintained by the constant volume of the aqueous in the chambers of the eye and by the constant volume of blood in the choroidal vessels. Regulating impulses, aside from the peripheral autonomic control by means of an electrolytic constellation, are derived from the parasympathetic nerve fibers and mediated by acetylcholine. There are no sympathetic nerve fibers in the choroid and probably very few in the ciliary body.

When the lack of regulating impulses and the deficiency in acetylcholine occurs suddenly, the rise in tension is sudden and the lens-iris diaphragm is pushed forward with a narrowing of the anterior chamber. The sudden rise in tension causes a sudden tenseness and stretching of the corneoscleral coat and a sudden interference with the circulating blood in the vessels of the uvea.

It is the suddenness of the increase in the ocular tension which is important. Depending upon the suddenness of the rise and upon its extent, there appear either prodromal symptoms or the full picture of acute congestive glaucoma. The acute attacks are episodes in the course of primary glaucoma in which the changes in the regulating impulses vary suddenly.

There is evidently a difference in the behavior of the disease in these cases from its behavior in the cases in which the deficiency in the regulating impulses is in a manner "regular," and the absence of sudden attacks gives the clinical picture of chronic simple glaucoma. This difference is, however, not a fundamental one, and the disease in either case is primary glaucoma, with the loss of regulation of the normal intraocular pressure as the primary factor.

Duke-Elder states: "Congestive glaucoma is an ocular malady the fundamental cause of which is a vascular instability, often, it is to be noted, not limited to the eye, the unstable phase being characterized essentially by vasodilatation, increased capillary permeability, and edema."

The term "vascular instability" is vague, nor does one know what vessels the author

has in mind. The retinal vessels are excluded altogether. They are under the dominance of the sympathetic system and do not partake in the maintenance of the intraocular pressure.

If by "vascular instability" the author means irregular changes in the tonus of the vessel walls, in the permeability of the capillaries, and in the volume content of the vessels of the uvea, as a result of irregularity in the parasympathetic nerve impulses and in the production of acetylcholine, one can agree with him. For such a vascular instability in these vessels in glaucoma is conceivable. Such an instability is strictly limited to the eye and to the vessels of the uvea. There is no evidence that as part of glaucoma such an instability is present in other parts of the body, especially where such vessels are dominated by sympathetic nerve impulses.

In another paragraph Duke-Elder notes: "Capillary dilatation leads to increased permeability, stasis, and local edema, and often to an increased tension in the eye."

I think that here the author puts the cart before the horse. The sequence of events is, first, the sudden rise of tension, then dilatation of the suddenly strangled vessels, stasis, and edema.

I have said that, as a result of the sudden increase in tension, the iris-lens diaphragm is pushed forward. As long as the angle of the anterior chamber is not obstructed, the disease is still strictly functional and responds to the substitution drugs.

With repeated prodromal attacks, many of which may cause no symptoms aside from colored halos around lights, the anterior chamber is narrowed still more. Now a sudden severe attack brings the root of the iris in apposition to the posterior surface of the cornea and the angle is blocked. A mechanical blocking of the angle is added to the functional rise of tension, and now the tension becomes extreme.

It is to the credit of Bänziger of Zurich[5] to have shown that, in these cases, the performance of a peripheral iridectomy is sufficient to relieve the mechanical block, to reëstablish the flow of aqueous from the posterior to the anterior chamber, and to permit the aqueous to flow out of the angle. And this without any artificial drainage out of the anterior chamber.

In speaking of the etiologic "factors which may cause this instability of the capillary circulation," Duke-Elder mentions some which cause secondary glaucoma. For the majority of cases, he assumes that we do not know the cause. But he accentuates "either singly, successively, or in combination, such factors as neuro-humoral anomalies, an upset in the neuro-vegetative balance between the sympathetic and the parasympathetic systems, endocrine dyscrasias, or the multitude of factors, physical or psychosomatic, especially those endowed with emotional tone, which are integrated in the thalamus and hypothalamic region."

There is no known balance between the sympathetic and parasympathetic systems in the control of the intraocular pressure. The sympathetic system has no control in the maintenance of the intraocular pressure. None of the known endocrine dyscrasias have any influence on the intraocular pressure. Increased emotional tone will, by irradiation, influence the ocular tension in glaucoma, but there is no evidence that any emotion, no matter how great, has ever initiated the disease.

Duke-Elder adds: "To this extent some cases of glaucoma—like nonrenal hyperpiesia, gastric ulcer, or thyrotoxicosis—may be classed as a stress disease."

I assume that by nonrenal hyperpiesia is meant what is generally known in this country as essential hypertension. None of these diseases are due to stress. I am well aware that gastric (peptic) ulcer is so considered, but there is really no proof for it. All these diseases do belong in one group. In each of them, including primary glaucoma, there is an inability on the part of the integrating mechanism to maintain a physio-

logic norm. In each of these diseases the inability to maintain the norm results in secondary organic changes.

In gastric (peptic) ulcer it is the inability to maintain the normal concentration of HCl; in thyrotoxicosis, it is the normal metabolic rate; in essential hypertension, it is the normal blood pressure; and in primary glaucoma, it is the normal intraocular pressure.

Each and every one of these diseases is at first strictly functional, the physiologic norm has escaped from control. In each of these diseases secondary organic changes eventually modify the clinical and pathologic pictures.

IV

Chronic simple glaucoma

This disease is primary glaucoma manifesting itself by an insidious onset and a slowly progressive course. It is functional in character in the early stages, until organic changes complicate the clinical and pathologic pictures. Its cause is the defective control exercised by the integrating mechanism, an inherited inherent condition.

Nerve impulses and acetylcholine reach the effector organ in the uvea irregularly—at times in normal amounts, at times in insufficient quantities when the intraocular pressure begins to rise. The irregularity of the nerve impulses is for a long time insidious and, for a long time, the course of the disease is not interrupted by sudden extra deficiencies in the production of acetylcholine. However, such sudden deficiencies do occur, with sudden sharp rises of the ocular tension. When such a sudden sharp rise strangles the vessels of the uvea, congestion appears.

Congestion does not occur when the vessels in the uvea have sufficient time to accommodate themselves to the rise in tension. Thus, acute attacks with or without congestion are variations of the clinical picture of primary glaucoma, which may run its course with few or without any such attacks.

Duke-Elder says of chronic simple glaucoma, "that it is a disease the essential feature of which is an inadequacy of the ocular circulation characterized by a lack of adaptive accommodation in the small vessels and a nutritional sclerosis of important tissues of the eye."

An inadequacy of the ocular circulation could mean a lessening in the regulation of the vessels of the uvea in their action as part of the effector organ for the maintenance of the intraocular pressure. And this could only be due, in the absence of organic changes, to the defective control by the parasympathetic nerve fibers. It is difficult to understand what the author means by nutritional sclerosis, what vessels and what part of the eye he has in mind.

Duke-Elder is certainly correct when he says that "a feature of the eyes of such patients, particularly at an early stage of the disease, is not so much a rise of tension as a distortion and exaggeration of the normal diurnal variation of tension." But I think he is wrong when he assumes that "The evidence is strong that it is due to rhythmic circulatory changes."

Normal rhythmic circulatory changes cannot produce a disease, and any abnormal circulatory changes could only be assumed to occur in the vessels of the uvea. Then there is at once the problem of why they are not controlled by the neural integrating mechanism.

Duke-Elder also speaks of the diurnal variations having an ascending phase where the tension rises above the base pressure, to fall again in a descending phase to the normal. It is in just such an ascending phase that the controlling nerve impulses and acetylcholine are deficient. The proof of this is given by the fact that this phase is abolished by drugs which are substitutes for acetylcholine, or by drugs which prevent the destruction of acetylcholine.

"The evidence indicates that, in the rising phase of tension, the ocular capillaries lack some control which is normally present."

This is quite correct if the uveal vessels are meant, and the lack is the chemical mediator, acetylcholine, which, when replaced by substitute drugs, abolishes the phase.

Duke-Elder states that "a significant number of patients with chronic simple glaucoma have a general vascular instability both in general blood pressure (which need not be high) and in local peripheral response to stimuli."

This is rather difficult to follow. A vascular instability in the local peripheral response to stimuli would have meaning here when applied to the vessels of the uvea. Possibly the vessels do not respond properly to acetylcholine, but they certainly respond to substitute drugs in the stages when the disease is strictly functional. Instability of vascular response to local peripheral stimuli in other parts of the body cannot possibly have any influence on the intraocular pressure.

Vascular instability in general blood pressure has no influence on the intraocular pressure. Individuals with all kinds of vascular hypertension are observed and followed until death without the occurrence of glaucoma. The ocular tension remains normal and is independent of any rise in the blood pressure. It has its own control which is parasympathetic, while control of blood pressure is by the sympathetic nervous system.

Again, diseases in which vascular instability predominates, such as Raynaud's disease, acrocyanosis, livedo reticularis, thrombo-angiitis obliterans, have not, as part of their clinical picture, an increase in ocular tension.

V

Finally, Duke-Elder conceives "primary simple glaucoma to be a condition characterized essentially by instability of vascular control and impairment of the capillary endothelium and sclerosis, associated with instability of tension."

This is a mixture of functional and organic elements with the instability of tension added.

I gave my conception of primary glaucoma in the summary at the beginning of this paper.

The essential points are:

1. That at first the disease is strictly functional, and is not due to any organic changes no matter how slight or subtle, whether in the angle of the anterior chamber, in the trabeculas, or in any vessels.

2. That it is due primarily to a deficiency of the normal parasympathetic control of the intraocular pressure, and to a deficiency in the production of the chemical mediator, acetylcholine.

3. That primary glaucoma is one disease, and that all variations in the clinical picture are due to the variations in the neural control and in the production of acetylcholine. Insidious continued deficiencies, in a way "regular," produce the picture of chronic simple glaucoma. Sudden deficiencies cause sudden acute rises in tension. When the rise is sudden and severe, interference with the blood flow in the vessels of the uvea produces the picture of acute congestive glaucoma.

I believe there is enough evidence to justify such a conception of primary glaucoma. It does away with the confusion which would divide the disease into a number of glaucomas, or would attach the ocular hypertension to congeries of disease conditions (aside from strictly secondary glaucoma).

It does not relegate the increase in tension to a secondary position, due to some unknown factor, but considers the intraocular pressure as the central element which the integrating mechanism is unable to control.

Such a conception of glaucoma corresponds with our understanding of the action of drugs which act as substitutes for acetylcholine, and of the drugs which prevent the destruction of acetylcholine.

It corresponds with the method of treatment of glaucoma by drugs while the disease is strictly functional, and with the use of surgical means when the addition of organic changes has complicated the clinical and pathologic pictures.

239 Central Park West (24).

REFERENCES

1. Duke-Elder, W. S.: The dependence of surgery on physiology. Am. J. Ophth., 33:11 (Jan.) 1950.
2. Elwyn, H.: Pathogenesis of chronic simple glaucoma. Arch. Ophth., 19:986 (June) 1938.
3. ———: Nature of glaucoma. Arch. Ophth., 38:506 (Oct.) 1947.
4. Hess, W. R.: Die funktionelle Organisation des vegetativen Nervensystems. Basel, Benno Schmalbe and Co., 1948.
5. Bänziger, T.: Die Mechanik des akuten Glaukoms und die Deutung der Iridectomie—Wirkung bei demselben. Ber. ü. d. dreiundvierzigste Versammlung d. deut. opth. Gesell. in Jena, 1922, p. 43.

SEPARATION OF DIENCEPHALIC CENTERS CONCERNED WITH PUPILLARY MOTILITY AND OCULAR TENSION*

ERNST SCHMERL,† M.D., AND BERNHARD STEINBERG, M.D.
Toledo, Ohio

The question of pupillary motility and ocular tension has engaged the attention of several investigators. The pupillographic studies of Lowenstein and Schoenberg[1,2] showed the involvement of tension and pupillary motility in glaucoma. Clinical investigations by Hess[3] and Zondek and Wolfsohn[4] emphasized the role of the diencephalon in this condition.

During our own experimental work on ocular tension we had found a number of conditions in which pupils and tension were simultaneously affected. This study is presented to indicate that pupillary motility and ocular tension are controlled by two distinct diencephalic centers. The findings were demonstrated by electric stimulation of various areas in the diencephalon, by introduction into the third ventricle of chemical substances such as calcium chloride and of water with and without narcosis of the animal.

TABLE 1

FARADIC STIMULATION OF DIENCEPHALIC CENTERS

Center Stimulated	Effect on Pupillary Motility	Change of Ocular Tension in mm. Hg (Schiøtz)	Number of Experiment
Area 1	Dilatation of pupil	−4	1
	Dilatation of pupil	−7	2
	Dilatation of pupil	−12	3
Area 2	Contraction of pupil	+4	4
	Contraction of pupil	+5	5
	Contraction of pupil	+5	6
	Contraction of pupil	+6	7
	Contraction of pupil	+11	8

Interpretation: This protocol indicates that the diencephalon contains two centers, one for pupillary contraction and one for dilatation. These centers are closely correlated to those controlling ocular tension.

EXPERIMENTAL PROCEDURES AND RESULTS

Electric stimulation of the diencephalon was accomplished by removing a part of the cortex and applying a weak Faradic current to an area just anterior to the pituitary gland. Dilatation of the pupil as described by Karplus and Kriedl[5] was obtained. This dilation was associated with a reduction of ocular tension (Table 1).

Stimulation of an area still anterior but closer to the pituitary gland induced a pupillary contraction and an increase in ocular

* From the Toledo Hospital Institute of Medical Research. This work was supported by a grant from the Snyder Ophthalmic Foundation.

† Research ophthalmologist of the Snyder Ophthalmic Foundation.

tension (Table 1). Care was taken not to stimulate the nerves supplying the external ocular muscles.

Intravenous and intraventricular introduction of calcium chloride and other procedures have been described by Meltzer and Auer,[6] by Demole,[7] and by Beattie and coworkers,[8] who obtained pupillary contraction. In our experiments, the chemical was injected at 20°C. into the third ventricle. Access was gained to the area by drilling a hole slightly anterior to the fronto-parietal suture and inserting a needle until it reached the sella turcica. The distal end of the needle was closed and an opening was made 5 to 7 mm. from the tip.

Within a few minutes after introduction of 0.1 cc. M/8 calcium chloride, the pupils became markedly contracted and the ocular tension became increased. These changes continued for 20 to 30 minutes (Table 2). Intravenous injection of the chemical, 4-5 cc. M/8 $CaCl_2$ per pound, showed similar changes but more pronounced and for a period of one hour. In addition, the irises became hyperemic, slightly hazy and bluish, the anterior chambers disappeared, and the refraction of several animals shifted from a hyperopia of 3.0D. to a hyperopia of 1.0D.

When the same experiments were performed under paraldehyde or nembutal narcosis, there was contraction of the pupils, but the change in the ocular tension was abolished (Table 2).

Injections of 0.1 to 0.2 cc. of distilled water at 20°C. were made into the third ventricle. Ocular tension became elevated from 3 to 11 mm. Hg in eight eyes. However, there was no contraction of the pupils. With nembutal and paraldehyde narcosis the ocular tension was increased but to a lesser degree.

These experiments demonstrate that there are distinct diencephalic centers for pupillary motility and ocular tension.

TABLE 2

EFFECT OF CALCIUM CHLORIDE INJECTED INTO THE VENTRICLE UPON PUPILLARY MOTILITY AND OCULAR TENSION

Number of Experiment	Increase of Ocular Tension in mm. Hg (Schiøtz) under Normal Conditions	Increase of Ocular Tension in:		Pupillary Motility		
		Paraldehyde Narcosis	Nembutal Narcosis	Under Normal Conditions	In Paraldehyde Narcosis	In Nembutal Narcosis
1	+6	±0	±0	Contraction		
2	+6	±0	±0	Contraction		
3	+8	−2	−1	Contraction		
4	+8	±0	−1	Contraction		
5	+9	−1	±0	Contraction		
6	+11	−1	−1	Contraction		
7	+13	−7	+10	Contraction		
8	+13	−4	+10	Contraction		

Interpretation: This protocol suggests that the diencephalic centers for pupillary contraction and ocular tension are not identical.

CONCLUSION

Under the conditions of these experiments, stimulation with a Faradic current of areas in the diencephalon and intraventricular injection of calcium chloride and distilled water with and without narcosis indicated the presence of distinct and separate centers for pupillary contraction and for elevation of ocular tension.

2805 Oatis Avenue (6).

REFERENCES

1. Lowenstein, O., and Schoenberg, M. J.: Nervous factor in the origin of simple glaucoma. Arch. Ophth., 31:384-391, 1944.

2. ———: Pupillary reactions of the seemingly unaffected eye in clinically unilateral simple glaucoma. Arch. Ophth., 31:392-398, 1944.
3. Hess, L.: Pathogenesis of glaucoma. Am. J. Ophth., 33:392-396, 1945.
4. Zondek, H., and Wolfsohn, G.: Glaucoma and pituitary function. Am. J. Ophth., 30:596-601, 1947.
5. Karplus, I. P., and Kriedl, A.: Gehirn und Sympathicus. Arch. f. d. ges. Physiol., 192:138-144, 1909.
6. Meltzer, S. J., and Auer, J.: The influence of calcium upon the pupil and the pupillomotor fibres of the sympathetic nerve. Am. J. Physiol. 25:43, 65, 1909.
7. Demole, V.: Phartm.-Anat. untersuchungen zum Problem des Schlates. Arch. f. exp. Path. und Pharm., 120:229-258, 1927.
8. Beattie, J., Brow, G. R., and Long, C. N. H.: The vegetative nervous system. The hypothalamus and the sympathetic nervous system. Proc. A. Research Nerv. & Ment. Dis., 1930.

GLAUCOMA: SOME SOCIAL AND MEDICAL ASPECTS*

DANIEL KRAVITZ, M.D.
Brooklyn, New York

Glaucoma still remains the greatest challenge to the ophthalmologist. All too often, in spite of all the known treatment, medical and surgical, our patients lose their vision even to absolute blindness. When one works in a clinic in which a large number of glaucoma patients are treated, the social aspect of this disease becomes evident and assumes an importance equal to that of the medical aspects.

From November 3, 1948, when the glaucoma clinic at the Brooklyn Eye and Ear Hospital was organized under my supervision, until November 1, 1949, 90 patients were referred for treatment and study. Column 1 in Table 1 indicates, as far as could be ascertained, the patient's age at the time of onset of the disease. Of the 90 cases, the age of onset in 81 (90 percent) was over 40 years. Analyzing these figures further, we find that 55 of the 81 cases were of the chronic variety, the majority involving both eyes. Four additional cases had

TABLE 1

ANALYSIS OF 90 CASES OF GLAUCOMA

Age	Male	Female	Chronic	Acute	One Eye	Both Eyes	Increased Tension and no Fundus Changes
0–10	1	1			1	1	
10–20	0	0	0	0	0	0	
20–30	1	1	2	0	0	2	
30–40	3	2	2	1	2	3	
40–50	4	8	8	3	7	5	
50–60	12	12	16	8	11	13	1
60–70	18	20	26	9	13	25	3
70+	5	2	5	2	2	5	
Total	44	46	59	23	36	54	4

* Read in part before the Brooklyn Ophthalmological Society, February, 1950.

increased tension without fundus changes. From these figures, we see that in 73 percent of our patients over 40 years of age, the glaucoma was of the insidious variety and likely to progress to a considerable loss of vision unless detected early.

The percentage of older persons in the general population has been increasing steadily, thus making glaucoma a social problem of great importance because, if the longevity curve continues to increase, we can expect to see a greater number of glaucoma patients. The early recognition of this disease is, therefore, of extreme importance. Since a majority of persons become presbyopic at about the age of 40 years, it is important that the examination for glasses in this age group be performed by those competent to take a proper history, to examine the anterior chamber and fundus, and, if necessary, to do special examinations such as tonometry, gonioscopy, and provocative tests.

According to the National Society for the Prevention of Blindness, at least 3,400 persons become blind because of glaucoma each year. This does not take into account those blind in one eye, those with considerable loss of vision but able to get around, and the very many cases not reported. The loss in earning power and in public money necessary to take care of these blinded persons and their families is a problem which affects every taxpayer and every social agency.

An adequate social service follow-up is an essential part of a glaucoma clinic because some of the patients are unable to comprehend the seriousness of their condition and may neglect themselves until too late for help. The following history is an example of such a case.

Case 1. A. L., a man, aged 42 years had gone to the New York Eye and Ear Hospital in 1941 where he was treated for glaucoma. He attended the clinic for only a short while and, in 1943, came to the Brooklyn Eye and Ear Hospital clinic. Examination at this time showed a cupping in both eyes and a tension of 32 mm. Hg (Schiøtz) in the right eye and 35 mm. Hg in the left eye. With pilocarpine (two percent) the tension dropped to 15 mm. Hg in both eyes but, after a few visits, he disappeared from the clinic, not to return until 1949. At this time, he had an absolute glaucoma in both eyes with only light perception and was beyond help.

An important recent advance in the early recognition of glaucoma has been the progress in the study of the chamber angle with the goniolens or prism. Recently a committee selected by the American Academy of Ophthalmology and Otolaryngology classified the glaucomas into two groups; (1) The narrow-angle and (2) the wide-angle glaucomas. This distinction can be more readily appreciated by gonioscopic examination. Nevertheless, this classification does not always adequately describe the cases with which one is confronted. It would seem that the old classification is sometimes more descriptive of the clinical condition, as the following case will show.

Case 2. A. R., a woman, aged 67 years, had been under treatment at the Brooklyn Eye and Ear Hospital since December, 1949, because of an acute attack of glaucoma in the left eye of three weeks' duration. The tension was 55 mm. Hg in the right eye and 26 mm. Hg (Schiøtz) in the left eye. Since the tension could not be controlled medically, an iridencleises was performed on December 14, 1949. After operation, the tension still remained above 35 mm. Hg (Schiøtz). She was, therefore, referred to the glaucoma clinic on February 8, 1950. At her first visit to the clinic, it was found that her right eye which had always been normal had a moderately and ovally dilated pupil. The eye was entirely white and the cornea was only slightly edematous, but tension was 60 mm. Hg (Schiøtz). Under slitlamp examination, the anterior chamber was found to be moderately shallow but, when examined with the goniolens, no ciliary zone was seen and there were a few adhesions which in places hid most of the trabecular zone. The tension in the right, operated eye, was 41 mm. Hg.

Under the new classification, this would be considered a shallow-angle glaucoma. But would not the old terminology give a better clinical description of the case—acute, noncongestive glaucoma?

It is true that, in an eye with a narrow angle, one cannot always state definitely—just on appearance alone—whether the angle is closed or whether the angle is able to function. Occasionally, one sees wide angles in eyes with high tension and narrow

angles in eyes that continue to have low tension over a period of many years. Other findings must be considered: the tension, fields, and provocative tests. Nevertheless, a narrow angle is of some prognostic importance and should put one on guard, as the following cases will show.

Case 3. P. S., a woman, aged 60 years, came to the office on April 16, 1949, with a history that, for 10 years she had been under treatment by the late Dr. Louis Feldman for glaucoma. She went to the doctor because of headaches and was given pilocarpine (two-percent) to be used at night only with complete relief of symptoms.

Examination. Vision was: O.U., 20/20. Tension was: 16 mm. Hg (Schiøtz) in both eyes and, under the slitlamp, the anterior chambers were of moderate depth. The fundi were normal.

She was advised to return a week later for further study and, in the interval, was not to use any drops. At the second visit, the tension was still 16 mm. Hg (Schiøtz) but gonioscopic examination revealed narrow angles so that no ciliary zones and only a small portion of the trabecular zones were visible.

Because of this, she was advised to continue the use of pilocarpine nightly. However, in some manner, the directions were misunderstood and no drops were used. On May 23, 1949, she returned with an acute attack of glaucoma in the left eye. The tension was 18 mm. Hg in the right and 65 mm. Hg in the left eye. Under treatment, the tension dropped to 16 mm. Hg. She was advised to continue the use of pilocarpine (two percent) at night only, with complete control of tension to date.

Case 4. A. B., a woman, aged 59 years, came to the eye clinic of the Brooklyn Eye and Ear Hospital on May 17, 1949, because of pains in the eyes every morning and over the right temple at night. The vision was 20/20 plus in both eyes and the fundi were normal. The tension was 26 mm. Hg (Schiøtz) in the right and 23 mm. Hg in the left eye. She was told to use pilocarpine (0.5 percent) morning and night, with complete amelioration of symptoms. On June 1, 1949, she was referred to the glaucoma clinic.

Gonioscopic examination revealed narrow angles with a good deal of pigment on the trabecular zone, especially in the region of Schlemm's canal. A zinc-sulphate solution was substituted for the pilocarpine, with a prompt return of the eye pains and temple headaches, although the tension remained around 30 mm. Hg. These symptoms disappeared immediately when she was put on pilocarpine again. The zinc-sulphate solution was prescribed at a later date and with the same results.

The last case was one of a few, the majority in Negroes, which showed a considerable amount of pigment on the trabecular zone, especially in the region of the canal of Schlemm. This brought up the interesting question of whether pigment can block the trabecular spaces leading into the canal of Schlemm and thus cause an increase in tension. The following two cases are illustrative of the condition.

Case 5. A Negro, aged 37 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital in May, 1949, complaining of pain in the left eye. Vision was: O.D., 20/15. O.S., 20/30. Tension was: O.D., 15 mm. Hg (Schiøtz); O.S., 48 mm. Hg. Pilocarpine (two percent) every four hours was prescribed and the tension promptly fell to 15 mm. Hg (Schiøtz) in the left eye. In July, 1949, he was referred to the glaucoma clinic.

Gonioscopy in the right eye revealed fairly wide angles with pigment deep in the angle and with a few adhesions of the iris to the trabecular zones. In the left eye, the angles were narrow and there was a considerable amount of free pigment in the angles which obscured the details.

Case 6. A Negro, aged 76 years, had a chronic glaucoma in both eyes of many years' duration. The tension in both eyes varied between 30 and 50 mm. Hg (Schiøtz), usually in the 30's regardless of whatever miotic was used. He was referred to the glaucoma clinic in November, 1948.

Gonioscopic examination revealed narrow angles, dense pigment in the region of the canal of Schlemm, and dense collections of pigment interspersed with tufts of capillaries on the last roll of the irides.

Interesting also, were the findings in two cases of essential atrophy of the iris.

Case 7. A man, aged 54 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital in October, 1947. He had an essential atrophy of the iris in both eyes. The tension was: O.D., 37 mm. Hg; O.S., 48 mm. Hg (Schiøtz). With pilocarpine, the tension in both eyes remained below 30 mm. Hg (Schiøtz). He was referred to the glaucoma clinic in January, 1949.

Gonioscopic examination revealed heaped-up pigment deposits on the irides with a considerable amount of pigment in the angles, obscuring the details in the angles.

Case 8. A woman, aged 34 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital in August, 1949. She had an essential atrophy of the right iris. The tension was 41 mm. Hg (Schiøtz), O.D.; 26 mm. Hg, O.S. The tension in the right eye could not be controlled with miotics. She was referred to the glaucoma clinic in October, 1949.

Gonioscopic examination of the right eye showed an excess of pigment on the iris, especially in the region of the last roll. The ciliary zone was not

visible but a good part of the trabecular zone was still visible. This area showed a moderate amount of pigment deposited on its surface. The angles in the left eye were normal.

This made us feel that, in some cases, there may be a defect in the excreting mechanism so that pigment could block the trabecular spaces with resulting glaucoma; while in others, so much pigment was set free that even the normal drainage channels were inadequate. The inevitable glaucoma which accompanies essential atrophy of the iris may be so explained; the blocking of these channels raises the intraocular pressure which produces peripheral synechias. This further increases the tension and a vicious cycle is set up. The final result is an absolute glaucoma, resistant to all therapy.

At the December meeting of the New York Society for Clinical Ophthalmology, Dr. Friedenwald* reported good results in these cases by treatment with Beta radiation after trephination.

That blocking of the trabecular spaces by pigment can be a cause of glaucoma is believed by many, notably Otto Barkan.[1] Others, especially Jonas Friedenwald,[2] disagree with this concept. The latter points to the fact that glaucoma is not found in patients with Krukenberg's spindle, although in these cases free pigment is deposited on the posterior corneal surface. However, it may be that the pigment is of a much finer texture or generated very slowly so that it does not plug the trabecular spaces. Following is an illustration of such a case.

Case 9. I. B. B., a white man, aged 51 years, an attorney, came to the office on February 22, 1950, because of blurred vision in the left eye for the past few months. He had been under my care since 1939 for a moderate myopia. Vision at that time was 20/70 in each eye, corrected to 20/20 with minus 1.0D. sph. The last examination prior to the present visit was in November, 1944, but he had been refracted twice in the interval by an optometrist with no change is his prescription.

Examination was 20/70, O.D., improved with a −1.0D. sph. to 20/20, plus. O.S., 10/200, improved with a −1.0D. sph. ⊃ −2.0D. cyl. ax. 150° to 20/100. The tension was 25 mm. Hg (Schiøtz) in both eyes. The right eye showed very fine golden-brown pigment deposits on the posterior corneal surface. These were present over the entire lower one fourth of the cornea but, in the middle, the pigment reached the lower pupillary border. There were no keratic precipitates or other signs of inflammation. No other abnormalities were noted in the eye.

The left eye had the same pigment deposits on the posterior cornea, involving a greater area, and extending upward to about the middle of the pupillary zone. There were diffuse posterior cortical lens changes. The rest of the eye showed no abnormalities.

The gonioscopic findings were interesting and the same in both eyes. The upper angles were wide and clear. The ciliary zones were darkly pigmented in keeping with the patient's irides which were dark brown. The trabecular areas were clear. The lower angles had a good deal of fine, dark brown, pigment granules scattered over the entire trabecular zones. No adhesions were present and the ciliary zones were visible. The lateral angles were clear in the upper halves, but the lower halves showed scattered pigment granules on the trabecular zones, sparse and practically limited to the region of the canal of Schlemm near the horizontal meridian, becoming more widespread and more densely packed below.

Friedenwald also stated that he had not found glaucoma to be more frequent in the Negro. The gathering of accurate statistics for this is very difficult but one cannot deny that glaucoma in the Negro is more intractable to treatment, medical or surgical. Pigment is often found deposited on the trabecular zone in cases with normal tension, especially in the aged, and in some cases the amount may not be inconsiderable. Further clinical and experimental study of the angles of darkly pigmented people with and without glaucoma is needed to clear up this interesting question.

Gonioscopy, as Peter Kronfeld[3] has pointed out, is valuable for the study of glaucoma in a retrograde fashion. The angles can be studied before and after the use of miotics and after operations. From the latter examination, one can often explain the good and poor results following surgery. One can state that, unless there is an unobstructed filtering area or a large section of open angle, an operation for glaucoma

* The third Mark J. Schoenberg Lecture, to be published in the AMERICAN JOURNAL OF OPHTHALMOLOGY.

will usually not be successful or only partially successful. There are, of course, exceptions. Sometimes, an angle that had had a basal iridectomy may seem to be obstructed, or a filtering area considerably blocked, yet the tension remained low. On the other hand, the postoperative appearance of the angle may seem to be excellent but the tension remained high. However, the exceptions do not obviate the rule already stated.

In our series, there were 32 cases that had been referred after operation because the tensions were not normalized by operation. A review of the gonioscopic findings in a few of these will prove instructive.

Case 10. A woman, aged 48 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital in January, 1948, with an attack of acute glaucoma in the right eye. The tension was above 70 mm. Hg (Schiøtz) and she was put on eserine and pilocarpine with a reduction of tension to 40 mm. Hg. Subsequently a trephination was performed with an immediate reduction of tension. In a month, however, the tension rose to 48 mm. Hg and could not be reduced. She was referred to the glaucoma clinic in March, 1949.

Gonioscopic examination showed the trephination opening to be filled with a plug of vitreous. Some lens capsule had proliferated through the trephine opening and was adherent to the trabecular zone. Obviously the trephine had gone too deep, injuring the lens capsule and breaking some of the zonular fibers, thus permitting vitreous to enter the anterior chamber.

Case 11. A man, aged 71 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital on January 25, 1949, with marginal ulcers of the left cornea for which homatropine (two percent) was prescribed. Two days later, he returned with an attack of acute glaucoma and a plus three tension in that eye. Since miotics would not control the tension, a modified Lagrange operation was performed but the tension following operation never went below 35 mm. Hg. He was referred to the glaucoma clinic in June, 1949.

Gonioscopy showed that the iridectomy was not basal but that a peripheral rim of iris had remained behind and was adherent to the trabecular zone. Gonioscopy of the other eye showed an angle so shallow that even the trabecular zone was not visible.

This case emphasizes the prognostic importance of a narrow angle. If the state of the angles had been known prior to operation, homatropine might not have been used.

Case 12. A man, aged 50 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital on October 27, 1948. Both discs were cupped, the right more than the left, and the tension was 40 mm. Hg (Schiøtz) in both eyes. Under miotics, the tension fluctuated between 30 and 50 mm. Hg so that four months later bilateral iridencleises were performed. However, the tension in the right eye continued to be above 30 mm. Hg, while that in the left remained below 26 mm. Hg. He was referred to the glaucoma clinic in July, 1949.

Gonioscopy of the right eye showed that the root of the iris was plastered against the trabecular zone and that the nasal pillar of the iris was adherent to the cornea. The temporal pillar was free. The angle of the left eye also showed adhesions of the root of the iris to the trabecular zone but both pillars were free.

Case 13. A man, aged 51 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital on October 11, 1943, with an acute attack of glaucoma in the left eye and a chronic glaucoma in the right eye. The tension was 15 mm. Hg in the right and 48 mm. Hg (Schiøtz) in the left eye. The tension in the left eye could not be reduced below 40 mm. Hg and, two weeks later, a trephining operation was performed on both eyes.

After operation, the tension in the right eye remained around 16 mm. Hg and that of the left remained above 30 mm. Hg, going as high as 40 mm. Hg, in spite of miotics. He was referred to the glaucoma clinic in August, 1949.

Gonioscopic examination showed a good unobstructed trephine opening in the right eye. In the left, some strands of tissue from the nasal pillar of the iris came through the trephine opening and were adherent to the trabecular zone, thus partially obstructing the opening.

Case 14. A woman, aged 45 years, came to the eye clinic at the Brooklyn Eye and Ear Hospital on March 24, 1941, because of poor vision in the right eye. Examination showed both discs to be cupped and tension was 41 mm. Hg (Schiøtz) in the right eye and 30 mm. Hg in the left.

Subsequently the tension rose higher and she went to another institution where basal iridectomies were done on both eyes. At a later date, the right eye was removed. Since the operation, tension in the left eye fluctuated between 40 and 65 mm. Hg (Schiøtz) although all the known miotics had been tried. She was referred to the glaucoma clinic in November, 1949.

Gonioscopy showed a swollen lens which had moved forward completely obliterating the angle and so interfering with drainage.

Medical treatment

We must confess that we have found no drug or combination of drugs which has given good results in all cases. However, certain drugs have given consistently better results than others. We did not treat the cases of acute glaucomas seen in the general

eye clinic, where they were treated. A review of the records, however, would seem to indicate that the most consistent and best results in lowering the tension was from a combination of eserine and pilocarpine or mecholyl and prostigmin, the latter being especially favored at the Brooklyn Eye and Ear Hospital.

In the special glaucoma clinic, the most uniform and best results have been obtained with pilocarpine in cases in which the tension was below 35 mm. Hg (Schiøtz). Pilocarpine has been effective over long periods of time, is well tolerated by patients, and gives the least amount of local reaction. It has been used in strengths up to five percent. In patients with higher tension than 35 mm. Hg, carbaminocholine (carcholin) has proved most effective and is usually well tolerated by our patients. Furmethide does not give such good results as carcholin; however, in two cases, no other drug but furmethide was able to control the tension.

D.F.P. has been somewhat of a disappointment, although, in three cases, it was the only drug that kept the tension under control. In two cases, the tension rose considerably and the pain became severe so long as D.F.P. was used. In one patient who had severe pain but in whom the tension was controlled, the pain was relieved by prior instillation of neosynephrin. D.F.P. should be tried in all cases that have not responded to other miotics. It may give a gratifying and unexpectedly good result as the following case will show:

Case 15. G. G., a woman, aged 26 years, came to the Brooklyn Eye and Ear Hospital in January, 1945, because of poor vision and headaches. Examination showed the corneas to be abnormally large and the pupils displaced eccentrically toward the nasal limbi. She also showed considerable myopia, with extensive myopic changes in the fundi. The vision was fingers at six inches in the right eye and light perception in the left eye, not correctible. Tension was four plus in both eyes, and could not be brought down with any of the miotics used.

On January 28, 1950, she came to the office because of severe and persistent headaches. Examination showed the corneas to be 14 mm. in diameter, the pupils were pinpoint and drawn to the nasal sides so that they were about 2.0 mm. from the limbi. The irides were also somewhat tremulous on movement of the eyes. On the temporal sides, the irides had large transverse rents through which the fundi details were visible. They revealed extensive and advanced myopic degenerative changes. Vision could not be improved beyond fingers at six inches in either eye. Gonioscopy showed broad adhesions of the irides to the trabecular zones, no ciliary zone was seen anywhere, and a fair amount of pigment was deposited on the trabecular zones. The tension was 90 mm. Hg (Schiøtz) in both eyes.

D.F.P. (0.05 percent) was prescribed, to be used morning and night. On February 10, 1950, the tension had dropped to 45 mm. Hg (Schiøtz) in the right eye and to 25 mm. Hg in the left eye, with complete relief from the headaches and eye pains.

Recently there was a report[4] of the greater efficacy of D.F.P. if a 0.05-percent solution was used instead of one of a 0.1-percent strength. More recently there was a paper[5] showing excellent results by using a 0.2-percent solution. It is difficult to reconcile the discrepancy. My own impression is that, as a whole, glaucoma clinics obtain better results with the use of any medication because of better supervision by the staff and better coöperation by the patients. These better results may be due to psychic or emotional factors. It is well known that psychic or emotional disturbances can bring on attacks of glaucoma. Therefore, anything that improves the psychic and emotional factors will help in the better control of the glaucoma.

One thing is certain, that the medical care of glaucoma cases is a vexing problem, and that no case should be given up until all known therapy has been tried.

Conclusion

With the increase in the older age groups in the population, we can expect an increase in the glaucoma problem.

To reduce the number of postoperative failures, greater care in the selection of the type of operation and especially in the operative technique is essential.

A glaucoma clinic is an important adjunct to an eye hospital because, through it, more effective treatment can be given the patients. It is also valuable as a training and research center.

861 Park Place (16).

References

1. Barkan, O.: Structure of the angle of anterior chamber. Arch. Ophth., 15:107 (Jan.) 1936.
2. Friedenwald, J. S.: Primary glaucoma. Tr. Am. Acad. Ophth., Jan.-Feb., 1949, p. 172.
3. Kronfeld, P.: Lectures on glaucoma. Tr. Am. Acad. Ophth., 1949.
4. Raiford, M. B.: Clinical evaluation of D.F.P. in glaucoma therapy. Am. J. Ophth., 32:1399 (Oct.) 1949.
5. Stone, W. C.: Use of di-isopropyl fluorophosphate (D.F.P.) in treatment of glaucoma. Arch. Ophth., 43:36 (Jan.) 1950.

TREPHINING OPERATIONS*

J. Alexander Van Heuven, M.D.
New Haven, Connecticut

Among the symptoms of glaucoma, the most striking and the one which causes the greatest concern is the rise in intraocular pressure. All therapeutic measures are therefore aimed at reducing the pressure and keeping it within normal bounds.

By normal pressure of an eye we mean "the pressure which the tissues of that particular eye are able to withstand without damage to their structures or impairment of their function" (Duke-Elder).

Speaking in terms of millimeters of mercury, I think that it is safe to designate 25 mm. Hg as the upper limit of normal, although I am aware that some authorities consider 30 mm. Hg as a high normal. In the treatment of glaucoma, we strive to obtain this normal pressure either by conservative methods or by surgery.

As far as surgery is concerned, among operations to relieve increased intraocular pressure, the classical iridectomy of von Graefe—although still the most frequently employed in acute glaucoma—has, in cases of chronic glaucoma, been superseded by various other operations. The most popular of these at the present time either seek to achieve permanent drainage by making a filtering scar or endeavor to create new pathways for drainage.

Although Heine's cyclodialysis and Otto Barkan's goniotomy strive to make new pathways for efflux, the filtering procedures, including Lagrange's sclero-iridectomy, Elliot's corneoscleral trephining operation, and Holth's iridencleisis, aim at obtaining permanent drainage by making a filtering scar.

In this paper I wish to discuss the operations to establish a filtering scar with special reference to Elliot's corneoscleral trephining operation—a procedure that had its inception in Lagrange's[1] sclero-iridectomy that was first modified by Holth[2] with punch forceps and then by Elliot[3] with the trephine.

More than in any operation with which I am familiar there has been for several years a geographically defined preference for each of these filtering operations. This adds to the difficulty of obtaining an evaluation of their relative merits. That Lagrange's operation was used with success in France is not surprising. Historically it was the first technique based on the principle of the filtering scar. Moreover, it was advocated by one of the most convincing speakers and one of the most delightful persons I have had the privilege to know.

Elliot's corneoscleral trephining operation is technically somewhat easier and, being British, became popular in the English-speaking countries, including the United States. Elliot's large series of cases in India was impressive and both his confidence in this operation and his self-criticism were illuminating.

Holth's iridencleisis covered a wide area in Scandinavia; everyone who watched and

* From the Department of Surgery, Section of Ophthalmology, Yale University School of Medicine.

heard him was almost convinced of the superiority of his procedure.

Since each of these operations meant an escape from unsuccessful attempts to preserve eyes suffering from chronic glaucoma, each of them was highly thought of. The difference in their outcome was not sufficiently striking to induce a surgeon, once familiar with one technique, to change to another. Each procedure aimed at checking the glaucoma at the point where it was at the moment of operation.

Elliot's operation had a more widespread popularity and remained a favorite for 25 years. Recently, however, its popularity appears to be waning. One of the reasons for this would seem to be the occasional occurrence of late infections, which may appear at any time after the operation. However, late infections have also been reported after Holth's operation.

A survey of the literature would tend to show that opinions concerning these techniques are far from unanimous.

Suglian[4] states that Elliot's operation has even gained in popularity and calls it the operation of choice wherever miotics fail to reduce abnormally raised intraocular pressure. Wheeler[5] believes it to be more effective than iridencleisis.

Arnold Knapp[6] calls it safer than any other method, causing fewer complications; he particularly stresses the point that its use should be limited to chronic glaucoma, iridectomy being indicated in acute glaucoma. As advantages of Elliot's operation, Knapp mentions the high percentage of cures, its wide applicability, the preservation of fields, barring accidents, and the small pupil which remains after the operation. He also mentions the following disadvantages: slow reformation of the anterior chamber, many detachments of the choroid, frequent ectatic scars, late infections, and the sudden drop in pressure. In a series of 532 eyes, Knapp records good tension in 80 percent, good vision in 42 percent, good fields in 35 percent, and late infections in 2.5 percent.

Shevchuck[7] reports 123 cases of Elliot's operation checked 2 to 20 years later. In 87 percent the tension was good but vision frequently continued to fail in spite of normal tension; the more advanced the disease at the time of operation, the more frequently this occurred. He mentions four cases of late infection.

Fillippov,[8] on the contrary, very strongly advocates cyclodialysis for all cases of chronic glaucoma as a result of his experience in 54 operations. They were free from serious complications, from sympathetic ophthalmia, and from late infections; they could be repeated.

Talbot[9] also states that cataract and late infections are fewer in cyclodialysis than in trephinations; this should not be surprising, since the former is a much less traumatizing operation. He does not communicate his final results, however. Walker[10] advocates trephination with a windowed trephine.

Kurz[11] calls trephination the operation of choice; his poor results were due to late operation. He reports on 98 eyes—75 percent were successful; 25 percent failures.

Clapp[12] was not in favor of the trephining operation at that time and states that it should rarely, if ever, be the operation of choice. Benedict[13] is in favor of corneoscleral trephination with a special conjunctival flap in order to promote subconjunctival drainage.

Bothman and Blaes[14] report on 244 eyes upon which trephining operations had been done; 91 percent of their cases were of simple glaucoma; the tension was lowered in 75 percent of all their cases. They saw cases of late infection but made no mention of their number.

Statistics of present study

In the present study are reported the results obtained in 391 eyes upon which a trephining operation had been done at least five years before the final check-up. These operations were performed by the late H. Snellen,

Jr., in the years 1913 to 1925 and by me in the years 1925 to 1942. Eliminated from this study are all cases which showed other eye diseases in addition to glaucoma. All eyes suffered from chronic glaucoma not secondary in type, and all patients had first been treated with pilocarpine.

Vision after operation remained the same as preoperative vision in 186 eyes, including four eyes already blind at the time of operation. Vision was worse in 205 eyes; however, in this category is listed any decrease of vision, independent of the cause.

Fields were the same postoperatively in 235 eyes. There was a decrease after operation of at least 10 percent of the preoperative visual field in 156 eyes.

After operation, tension remained under 26 mm. Hg (Schiøtz) in 314 eyes, including 15 eyes, in patients under 17 years of age, which showed marked hypotony. In 77 eyes, tension after operation was above 26 mm. Hg (Schiøtz).

There was a filtering scar present in 291 eyes, and a nonfiltering scar in 100 eyes.

A scar is considered to be filtering when one of the following four conditions was present:

1. Spontaneous positive potassium fluorescinate test. One drop five-percent cocaine is instilled. After five minutes, the patient is asked to look down and the upper eyelid is lifted. A drop of two-percent potassium fluorescinate is put in the upper conjunctival fornix and allowed to run over the eye. This colors the eye red; now the scar of Elliot's operation is observed. After a variable but short time, somewhere on the scar a green spot may be noticed. This grows larger and larger and may end in a small green current. This shows the dilution of the potassium fluorescinate, which turns green.

2. The same phenomenon appears after slight pressure on the globe.

3. The potassium-fluorescinate test is negative, but, after light pressure on the globe or massage, the cystoid bleb or flattened scar becomes enlarged.

4. When this test also is negative, the tension is taken on each eye on the following day. Then both eyes are massaged; this test is called positive when the operated eye shows a greater drop in tension than its fellow.

If these four tests are negative, the scar is called nonfiltering. However, I am convinced that, even when the test is negative, there are still a number of hidden scars which have microscopic filtration, clinical demonstration of which is impossible.

There were two eyes which developed cataracts because of direct trauma to the lens during operation. Late cataracts, nontraumatic in form, developed or increased in 105 eyes. At the moment of operation many patients already showed an incipient senile cataract, which would have increased even if there had been no operation.

Experience of many years, however, teaches that an operation upon an eye in which a cataract is already present tends to cause an increase in the cataract. Moreover, cataracts will increase more rapidly in any eye in which pathologic conditions exist. This definitely applies to any eye presenting a condition as serious as glaucoma. It is necessary, therefore, to disagree with Davenport[15] who mentions that "there seems to be no evidence that trephine-operation predisposes to cataract."

Immediate infections were seen in four eyes, and there was complete recovery in all four instances. By "immediate infection" is meant the condition of an eye in which the inflammation is sufficiently extended to demand unusual treatment. It does not include the chemosis that is occasionally seen. It does, however, indicate the presence of such redness, discharge, or even hypopyon as would demand milk injections or, in recent years, treatment with sulfonamides.

There were no cases of late infection and no cases of sympathetic ophthalmia.

Hemorrhages which caused no permanent damage occurred in 107 eyes. Any eye which showed any blood in the anterior chamber on

the third day after operation or later is included in this group, if the eye cleared completely. Only opacities in the vitreous which impaired vision and permanently hampered ophthalmoscopy justified listing an eye under the category "hemorrhages with permanent damage." There were six eyes in this group.

It should be mentioned that I have repeatedly seen a separation of the choroid after trephining operations. After Weve had drawn my attention to this finding, I noticed it more frequently. I think that, if ophthalmoscopy is performed during the first couple of days after the operation, separation of the choroid will be found a great deal more often than is expected. As a rule this condition disappears both quickly and completely.

A breakdown of the findings in all cases shows that after five years or more vision was decreased in 52 percent, visual fields were decreased in 39 percent; tension remained above the normal in 20 percent; the scar was called "nonfiltering" in 25 percent; in 24 percent cataract developed; and in 25 percent there were insignificant postoperative hemorrhages.

That decrease in vision was relatively greater than decrease in visual fields was mainly due to developing cataract. Normal tension was achieved in more cases than would have been expected if only the filtration of the scar, as noted by the various tests already described, had been considered. A great number of cataracts developed. The large number of filtering scars proved that the indication for operation was correct.

However, the record becomes more interesting when it is broken up into two groups: one containing those eyes which had already lost considerable vision and/or field before the operation and another those eyes in which the loss was less than 10 percent.

Five years or more after operation in the group of eyes in which vision and/or fields had been poor at the time of operation, vision was worse in 90 percent, and fields were worse in 93 percent. However, the tension remained within the range of normal in 86 percent and there was a filtering scar in 76 percent.

Cataract developed later in 50 percent; transitory hemorrhages in 31 percent. Of the six cases listed under "hemorrhage with permanent lesion" three out of the large group belonged to this subgroup.

In the group with good eyes at the time of operation, vision deteriorated in five percent; fields in seven percent; tension remained controlled in 96 percent; a filtering scar was present in 90 percent; late cataract developed in nine percent; transitory hemorrhages in eight percent. When we lift from this group the figures representing the eyes of patients under 55 years of age, the results become even better.

These figures show the difference in results in relation to the phase of glaucoma at the moment of operation. I should not be surprised if a similar statistical study of cases upon which Holth's operation had been performed showed similar results.

Looking once more into the literature it is interesting to find that Troncoso[16] states that the results in trephining operations depend largely on the moment of operation and the number of infections. Both he and Reese[17] are in favor of trephination. They advise operating as early as possible and examining the angle of the anterior chamber both before and after operation.

Interesting statistics are given by Brausewetter[18] who performed the Elliot trephining operation on one eye of 75 patients, and on the other eye of the same patients performed the Holth operation. His total successes were 77 percent of all cases. A second operation was necessary in 11 cases after the Elliot operation and in 19 cases after the Holth. After four years, 13 eyes treated according to Elliot and 11 after Holth's operation were blind. He had no infections after Holth's operation and four infections after Elliot's.

Thomson[19] found, after performing tre-

phining operations on 244 eyes, that 75 percent were successful; he reports four cases of late infection.

In conclusion I should like to state that I still consider trephination a useful operation in cases of simple glaucoma. The earlier it is done, the better will be the results.

244 Edwards Street.

I wish to thank Dr. Eugene M. Blake for the use of his glaucoma library and Dr. F. A. Wies for his assistance.

References

1. Lagrange, F.: Arch. d'Opht., **26**:481, 1906.
2. Holth, S.: Norsk. mag. f. laegevidensk., **6**:263, 1908.
3. Elliot, R. H.: Ophthalmoscope, **7**:804, 1909.
4. Suglian, V. V.: Bull. Pract. Ophth., **17**:3, 1947.
5. Wheeler, J. M.: Tr. Sect. Ophth., A.M.A., 1936, p. 112.
6. Knapp, A.: Am. J. Ophth., **16**:298, 1933.
7. Shevchuck, I. P.: Vestnik. oftal., **17**:51, 1940.
8. Fillippov, V.: Sovet. vestnik. oftal., **6**:57, 1935.
9. Talbot, C.: Suppl. New Zealand M. J., 1947, p. 37.
10. Walker, C. B.: Arch. Ophth., **3**:517, 1931.
11. Kurz, J.: Oftal. Sbornik, **5**:99, 1930.
12. Clapp, C. A.: Tr. Am. Ophth. Soc., **32**:191, 1934.
13. Benedict, W. L.: Arch. Ophth., **24**:1005, 1941.
14. Bothman, L., and Blaes, M. J.: Am. J. Ophth., **19**:1072, 1936.
15. Davenport, R. C.: Brit. J. Ophth., **10**:478, 1926.
16. Troncoso, M. U.: Am. J. Ophth., **23**:270, 1940.
17. Reese, A. B.: J.A.M.A., **112**:1204, 1939.
18. Brausewetter, G.: Proc. Ophth. Soc. Vienna, 1942, p. 6.
19. Thomson, H.: Acta ophth., **17**:301, 1939.

THE VISUAL FIELD AS AN AID TO PROGNOSIS IN GLAUCOMA

Adolph Posner, M.D., and Abraham Schlossman, M.D.
New York

Visual-field studies are valuable not only in the diagnosis of glaucoma, but also as an aid in predicting the subsequent course which the disease is likely to follow. This prognostic aspect has not received the attention it merits, probably because the many variations in the appearance of the glaucoma field render analysis difficult. However, by breaking down each field into certain component units, it is relatively simple to evaluate the past development of the disease and to predict its probable future course. The evolution of the glaucoma field has been discussed in a previous paper.[1] Figure 1 illustrates schematically the relationship between the distribution of blood vessels and nerve fibers in the retina on the one hand, and the visual field on the other.

The principal components of the typical glaucoma field are the arcuate scotoma and the nasal defect. The arcuate scotoma results from a widening and accentuation of the normal angioscotoma tree and represents an irreversible stage of the latter. The nasal defect is produced by damage to those nerve fibers which originate in the temporal quadrant of the retina. These fibers probably become affected near the nerve, in that part of the retina which corresponds to the arcuate scotoma. In addition to these two components, one sometimes encounters a small defect adjacent to the nasal border of the blindspot and extending toward the fixation area. Since this defect terminates in the horizontal meridian in a manner analogous to the nasal step, it has been named the

juxtacecal step. A more extensive outline of the evolution of typical and atypical field changes is given in Table 1.

From the prognostic point of view, it is practical to consider the upper and lower halves of the field as being more or less independent of each other. The widening and accentuation of the normal angioscotomas may occur either in one or both half-fields (fig. 3). The upper angioscotomas are the first to be involved in about two thirds of the cases. If a glaucomatous process is arrested at this early stage, either spontaneously or through treatment, a partial or complete regression of the scotomas can take place. However, once the arcuate scotoma has become fixed, it is not affected by treatment. Moreover, a nasal step may develop in the corresponding half-field and, once formed, it may progress even after the tension has been brought under control. This may be accounted for by assuming that certain nerve fibers which pass through the retinal area corresponding to the arcuate scotoma have already been damaged. This process may continue until the nasal quadrant and much of the temporal portion of the corresponding half-field are lost. Meanwhile, the other half-field may remain perfectly normal, provided that an arcuate scotoma has not already appeared there. Once the upper or lower half-field has been lost, attention should be centered on the normal half-field.

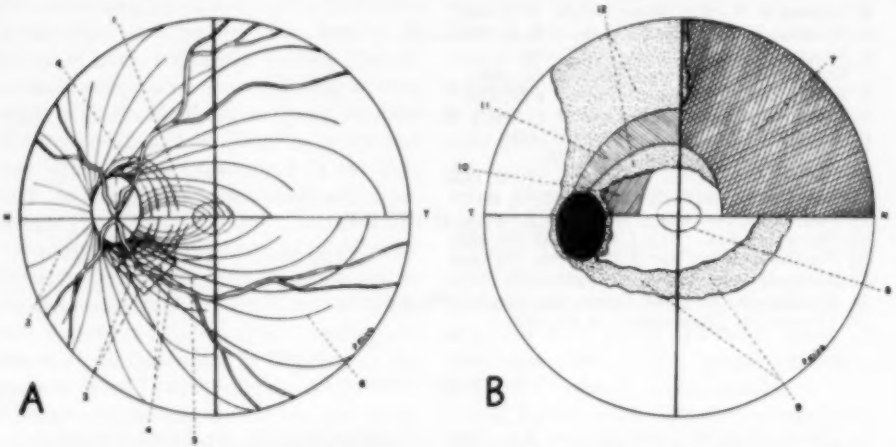


Fig. 1 (Posner and Schlossman). Schematic representation of visual-field defects in glaucoma in relation to retina. (A) indicates arrangement of nerve fibers and blood vessels in the retina; (B) shows a typical visual field in glaucoma. (1) Papillomacular bundle; (2) nasal fan; (3) area of greatest nutritional disturbance; (4) nasal fibers to area between disc and macula; (5) nasal fibers; (6) temporal fibers; (7) defect in upper nasal field, showing nasal step; (8) fixation area; (9) lower arcuate scotoma; (10) juxtacecal step; (11) upper arcuate scotoma; (12) intermediate zone between arcuate scotoma and nasal defect.

The area of maximum circulatory disturbance (3) corresponds in part to the arcuate scotoma (11). Nasal and temporal fibers passing through this area may become involved, resulting in the juxtacecal step (10) and nasal defects (7), respectively. Intermediate zone (12) is partly neural and partly circulatory in origin. (Reprinted with permission: From the *Archives of Ophthalmology*, 39:624 (May) 1948.)

The sudden appearance of an arcuate scotoma in the normal half-field is a graver prognostic sign than the mere presence of a moderately increased ocular tension.

The following two cases illustrate this point:

TABLE 1

COMPONENT UNITS OF THE FIELD DEFECTS IN GLAUCOMA

A. Defects caused by local damage to neurones and synapses:
1. Widening and accentuation of normal angioscotoma tree
2. Enlargement of blindspot
3. Arcuate scotoma

B. Remote defects caused by interference with conduction of nerve fibers which pass through affected region of the retina:
1. Contraction of the field to the smallest test objects
   a. Concentric
   b. Predominantly nasal
   c. Baring of the blindspot
2. Defects with hemianopic characteristics
   a. Horizontal hemianopic type
      1. Nasal step
      2. Juxtacecal step
      3. Altitudinal hemianopia
   b. Vertical hemianopic type
      1. Termination of the arcuate scotoma at the vertical meridian
      2. Termination of the nasal quadrant defect at the vertical meridian
3. Field changes in later stages
   a. Ring scotoma, either separate from, or fused with, nasal defect
   b. Loss of the entire field, except for:
      1. Central 5 degrees
      2. Temporal island

C. Less typical field defects
1. Early loss of the fixation area
   a. By encroachment of angioscotomas
   b. By extension from the blindspot forming a cecocentral scotoma.
2. Early involvement of temporal field, usually associated with the corresponding temporal angioscotoma (fig. 2).

CASE 1

Louis T., aged 50 years, with bilateral chronic simple glaucoma, had had a trephination, O.S., 1933; iridencleisis, O.D., 1940. In April, 1941, the right field showed an upper nasal quadrant defect merging with a wide upper arcuate scotoma.

The last field, June, 1949, shows that the upper half-field had been completely lost except for an area temporal to the blindspot, while the lower half-field had remained unaffected. The vision had remained 20/20 with correction (figs. 4 and 5).

This case illustrates the independence of the two half-fields with regard to time of involvement.

CASE 2

Isadore A., aged 58 years, had bilateral chronic simple glaucoma. A bilateral trephination was done in 1938. In Septem-

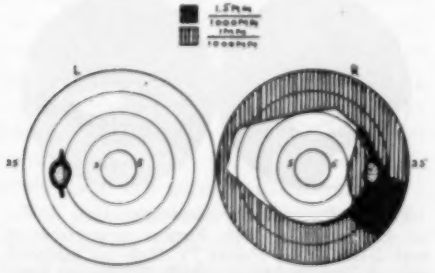


Fig. 2 (Posner and Schlossman). O.D., temporal field defect related to inferior temporal angioscotoma.

Fig. 3 (Posner and Schlossman). Widening of the angioscotoma tree.

Fig. 4 (Posner and Schlossman). *Case 1.* Visual field of April, 1941. O.D. shows formation of upper horizontal hemianopia by merging of nasal quadrant defect, arcuate scotoma, and juxtacecal step.

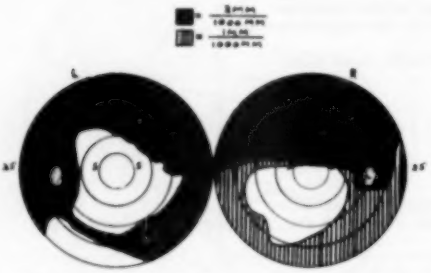


Fig. 5 (Posner and Schlossman). *Case 1.* Visual field of June, 1949. O.D. shows horizontal hemianopia. The lower half-field has remained unchanged for eight years.

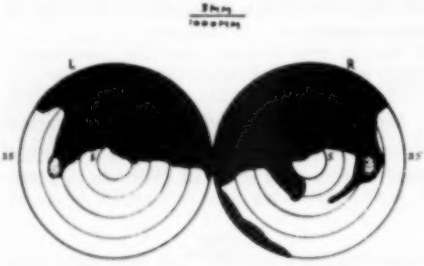


Fig. 6 (Posner and Schlossman). *Case 2.* Visual field of September, 1939. O.D. shows upper nasal field defect merging with a wide arcuate scotoma. Lower half-field shows an incomplete arcuate scotoma. O.S. shows an upper nasal field defect merging with a wide arcuate scotoma.

ber, 1939, the right eye showed an upper nasal field defect merging with a wide arcuate scotoma. An incomplete arcuate scotoma was already present in the lower half-field. This continued to enlarge and eventually led to a lower nasal field defect.

The left eye showed initially a similar involvement of the upper half-field but no involvement of the lower. In 1941, an arcuate scotoma was discovered in the lower half-field. Despite apparent normalization of the ocular tension, the arcuate scotoma widened and led to the formation of a defect in the lower nasal quadrant of the left eye (figs. 6, 7, and 8).

This case again lays emphasis on the independence of the upper and lower half-fields on the one hand, and on the interdependence of the arcuate scotoma and the nasal defect on the other hand.

It is interesting to note that in some cases the development of the field defects follows a similar pattern in the two eyes, even

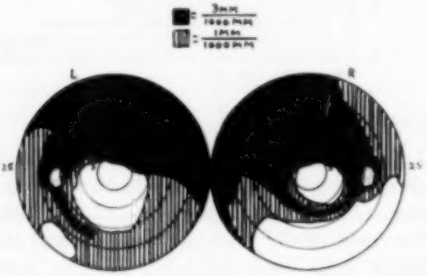


Fig. 7 (Posner and Schlossman). *Case 2.* Visual field of June, 1941.

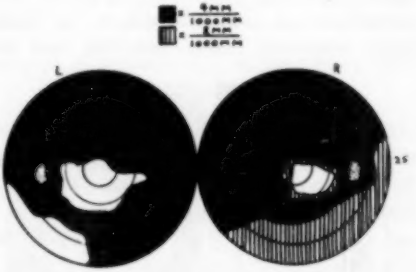


Fig. 8 (Posner and Schlossman). *Case 2.* Visual field of July, 1946. Further progression of field defects. (See Figure 7). Note the independence of upper and lower half-fields; also the interdependence of nasal defect and corresponding arcuate scotoma.

though the changes do not occur at the same time.

CASE 3

Mary S., who had asymptomatic glaucoma simplex, O.U., was first seen in April, 1941, with a well-developed lower nasal quadrant defect of the right eye connected with the blindspot by an arcuate scotoma (fig. 9). At this time, the left eye showed only a suggestion of a lower nasal defect to a 1.0-mm. test object.

In June, 1942, this defect in her left field extended centrally and was bordered by a denser zone which was the beginning of an arcuate scotoma (fig. 10). The field of the left eye continued to contract, so that by October, 1945, it had reached a stage resembling the field which the right eye had shown in March, 1941. Meanwhile, the right field had undergone additional deterioration (fig. 11).

This case is interesting because it shows that the field of the left eye became practically the mirror image of that of the right eye, though it lagged six years behind. While not attempting to generalize from this one case, the frequent occurrence of similar instances leads one to suspect that local anatomic and physiologic factors may play a part in determining which portion of the field is to be first affected.

The horizontal meridian and, occasionally, the vertical meridian passing through the fixation point, form physiologic and probably anatomic boundaries which tend to halt the progress of a field defect, at least temporarily. In this manner, the glaucoma field frequently assumes the characteristics of a vertical (fig. 12) or horizontal (fig. 13) hemianopia. In Figure 13, the horizontal border of the defect is formed by a fusion of the nasal step with the juxtacecal step.

The juxtacecal step resembles the nasal step by having a straight horizontal border. Since a vascular raphé is not present in the region between the disc and the macula, the juxtacecal step probably represents an involvement of those nasal nerve fibers which originate between the macula and the disc and which curve around the disc to enter the nasal half of the optic nerve (fig. 1-4). Excellent examples of juxtacecal steps,

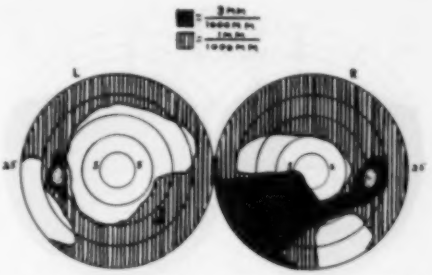


Fig. 9 (Posner and Schlossman). *Case 3.* Visual field of March, 1941. O.D., lower nasal quadrant defect connecting with arcuate scotoma. O.S., early lower nasal defect.

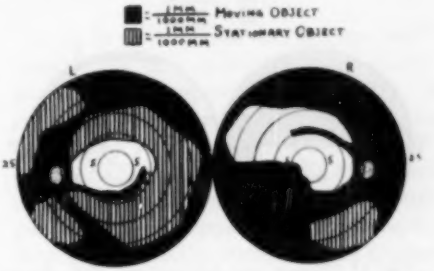


Fig. 10 (Posner and Schlossman). *Case 3.* Visual field of June, 1942. O.S. shows development of lower arcuate scotoma with progression of lower nasal defect.

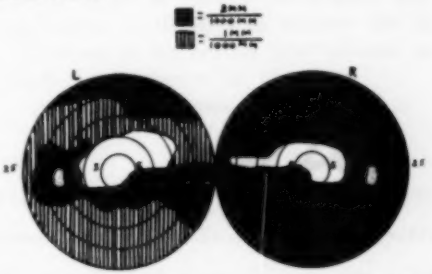


Fig. 11 (Posner and Schlossman). *Case 3.* Visual field of October, 1945. O.D. shows further progression. O.S. shows increase in lower nasal defect and arcuate scotoma. Note similarity to field of O.D. in Figure 9.

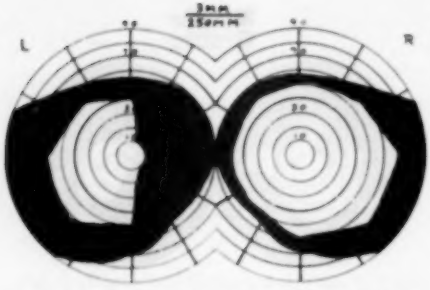


Fig. 12 (Posner and Schlossman). O.S. shows nasal hemianopia in glaucoma.

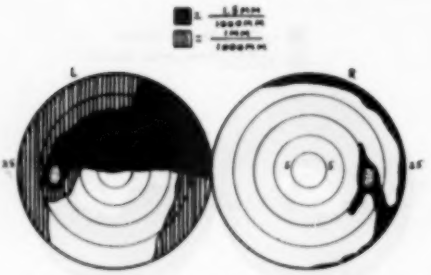


Fig. 13 (Posner and Schlossman). O.S. shows horizontal hemianopia in glaucoma. Note similarity to field found in closure of inferior temporal branch of central retinal artery.

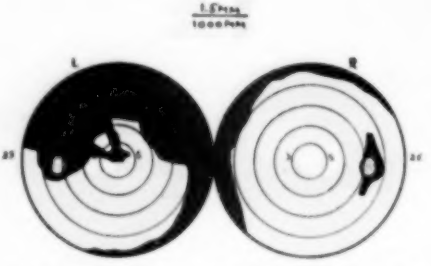


Fig. 14 (Posner and Schlossman). O.S., vision 20/100. Central scotoma formed by junction of two angioscotomas.

though not referred to as such, may be found in the textbooks of Traquair[2] and Lauber.[3]

The fixation area usually remains unaffected for a long time. While the reason for this sparing has not been definitely established, the explanation which seems most plausible to us is one which assumes that the papillomacular fibers do not cross the area of the retina corresponding to the arcuate scotoma. An additional factor may be the independent blood supply of the macula, both from the choroid and retina.

Any reduction in central visual acuity, in the absence of observable changes in the eye, is presumptive evidence for the presence of a central scotoma. In all such cases the central area should be carefully explored with small test objects. When no central scotoma is found, the close proximity of a nasal step to the fixation point may explain the periodic obscuration of vision about which such patients often complain.

At this time, we would like to call attention to those atypical cases in which the

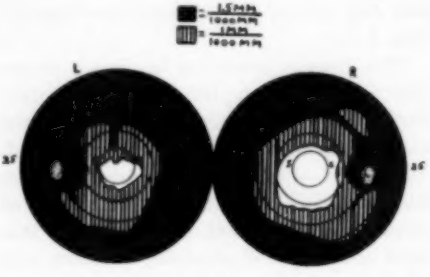


Fig. 15 (Posner and Schlossman). O.S., vision 20/25. Vertical angioscotoma extends toward fixation point.

macula becomes involved relatively early in the course of the disease. Such cases are not so rare as is generally assumed.

The early involvement of the fixation area may take several forms. Figure 14, left eye, shows how two angioscotomas have encroached upon the fixation area to form a central scotoma. Vision was 20/100. Figure 15, left eye, shows an angioscotoma extending vertically downward toward the fixation point. The vision in this eye was 20/25 while the other eye had an acuity of 20/15. Figure 16 shows the central fields of a patient whose corrected vision has been 20/70

in each eye for several years. The perimetric field still shows normal limits with a 6.0-mm. test object.

CASE 4

This case illustrates the development of one form of central scotoma in a 68-year-old white man with chronic simple glaucoma, whose fields up to that time had remained unchanged for several years. In March, 1946 he suddenly noticed a gray smudge in front of his left eye.

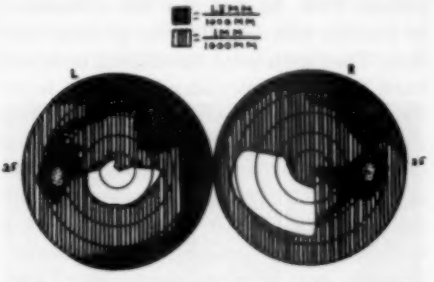


Fig. 16 (Posner and Schlossman). Vision, O.U., 20/70. Early involvement of fixation areas.

The central field at this time (Fig. 17) showed a fingerlike scotoma extending from the blindspot to involve the lower portion of the fixation area. The vision was reduced to 20/70. This scotoma has remained unchanged to the present.

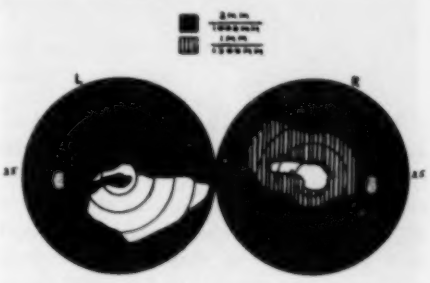


Fig. 17 (Posner and Schlossman). *Case 4.* O.S., vision 20/70. Finger-like scotoma extending from blindspot to lower portion of fixation area.

CONCLUSIONS

A study of the visual field in glaucoma is valuable not only from the diagnostic but also from a prognostic point-of-view. A glaucoma defect may be best analyzed by subdividing it into characteristic components. The most important of these units is the arcuate scotoma since it determines the future development of the associated defects in its respective half-field. The appearance of an horizontal hemianopia may be explained as a merger between the nasal and juxtacecal steps. Reduction of central visual acuity should be carefully investigated with the object of discovering whether the involvement of the central field indicates an early or late stage of the disease.

667 Madison Avenue (21).

REFERENCES

1. Posner, A., and Schlossman, A. Development of changes in visual fields associated with glaucoma. Arch. Ophth., 39:623 (May) 1948.

2. Traquair, H. M.: Introduction to Clinical Perimetry. London, Henry Kimpton, 1946, Ed. 5, p. 131, fig. 78B.

3. Lauber, H.: Das Gesichtsfeld. Munich, J. F. Bergman; Berlin & Vienna, Springer, 1944, p. 169, fig. 67.

IRIDOSCHISIS AS A CAUSE OF GLAUCOMA*

CLEMENT MCCULLOCH, M.D.
Toronto, Ontario

The term iridoschisis has been coined by Loewenstein and Foster to describe a special type of atrophy of the iris in which the ruptured fibers of the stroma appear free at one end but attached at the other, and float in the anterior chamber. Their own experience, and a careful review of the literature, led them to the opinion that this is a separate entity, distinct from essential atrophy of the iris.

Loewenstein and Foster,[1] and later Loewenstein, Foster, and Sledge,[2] reported cases of iridoschisis which were complicated by glaucoma. In both of their cases the disease appeared after injury to the eye. They suggested that blunt trauma has forced fluid into the stroma of the iris and broken the tissue, so that some of the fibers float free in the anterior chamber. Pigment liberated from the pigment epithelium has blocked the drainage channels at the angle of the anterior chamber, causing glaucoma.

The present case may throw further light on the mechanism of glaucoma complicating iridoschisis.

CASE REPORT

A 56-year-old white woman was first seen in August, 1944. She complained of intermittent attacks of pain in both eyes which had occurred for the previous several years. During that time her vision had been poor and she felt it was continually failing.

Her visual acuity was: O.D., 4/200, correctible to 6/200; O.S., 4/200, correctible to 6/200. There was eccentric fixation present with either eye and a searching nystagmus. The left pupil was slightly larger than the right. Both pupils reacted sluggishly to light and accommodation. Both fundi showed many areas of degeneration and widespread dispersion of pigment. The tension of the right eye was 15 mm. Hg (Schiøtz), that of the left eye was 26 mm. Hg.

The patient was not seen again until September, 1948. At that time she complained of pain in both eyes for the previous two days. The pupils were semidilated, oval, and fixed. There was considerable ciliary injection. The right cornea was steamy. The tension of the right eye was 50 mm. Hg, that of the left eye was 40 mm. Hg. Eserine salicylate (0.25 percent) ointment was instilled in both eyes and the patient was sent home to use the ointment every two hours. She was next seen two weeks later, when both eyes were white and comfortable and the tension was normal.

On October 13th, November 10th, November 22nd, and December 6th, the patient had hypertension in both eyes which recovered either after treatment with miotics, or spontaneously. On December 13th a cyclodialysis was done on the right eye. While there was no complication at the time of the operation, recovery from this procedure was stormy.

On December 29th the tension of the right eye was 22 mm. Hg, there was considerable tearing and pain in the eye. These symptoms subsided gradually and, since that time, except for one occasion in November, 1949, the tension in the right eye has been normal.

The left eye showed attacks of hypertension in February, June, September, and November, 1949, and January, 1950. On September 26, 1949, a complete iridectomy was done on the left eye. Recovery from this operation was also stormy and in November, 1949, and January, 1950, there were short attacks of hypertension.

During this prolonged period of attendance at the clinic and in the hospital, a number of findings were recorded which can be lumped together. It has already been

* From the Department of Ophthalmology of the University of Toronto and the Toronto Western Hospital.

mentioned that the patient has nystagmus and eccentric fixation.

During the periods between attacks of glaucoma her eyes appear white and normal. Slitlamp examination shows some precipitates on the back of the cornea. There are no floaters, nor is there a flare in the anterior chamber. There are no posterior synechias.

The iris shows a peculiar bursting forward of the stroma (fig. 1). The pigment of the iris appears normal and the pigment ruff

Fig. 1 (McCulloch). Left eye, iridoschisis.

at the pupil is intact. When she was first seen, there were a few, small, cleftlike opacities in both lenses; these have gradually increased until there are marked nuclear and cortical opacities in both lenses.

The vitreous in both eyes shows a number of stringy floating bodies. The fundus of both eyes is occupied by a patchwork of pale, yellowish lesions. These tend to be round, although they are rather irregular in shape. Scattered about the pale areas, and in some places on top of them, are clumps and strands of pigment (fig. 2). The discs are pale, flat, but not grossly cupped.

Gonioscopy reveals an open angle, no obstruction by pigment, and normal ciliary processes, in both eyes. Because of the eccentric fixation and the nystagmus, field

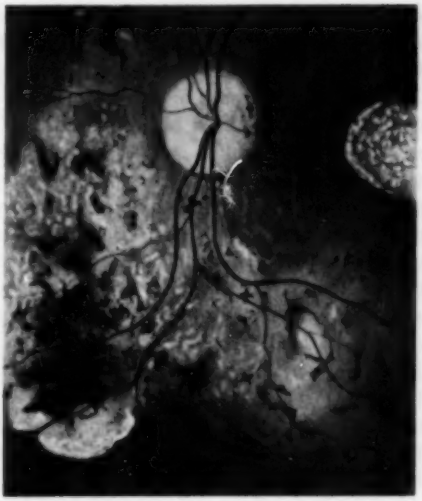


Fig. 2 (McCulloch). Fundus of the left eye, choroidoschisis.

studies were unreliable; to fingers the fields of both eyes were relatively full. She describes what probably represents multiple scotomas in her fields.

General physical, nose, throat, and dental examinations are all normal. Her blood pressure is 150/90 mm. Hg. The blood serology is negative. The urine is negative for albumin, acetone, sugar, and blood; hemoglobin and white blood counts are normal. Roentgenograms of the chest are clear. The tuberculin test is negative. She cannot remember when she has been sick with other than her eye trouble.

During these frequent attacks of glaucoma she has been treated with eserine, pilocarpine, carcholine, atropine, hot compresses, and also by operation. In any individual attack the various forms of medical treatment have not shown any great benefit or harm. Except for one attack, the cyclodialysis has controlled the tension in the right eye. The iridectomy has made no difference to the course of the glaucoma in the left eye.

Discussion

The condition of the iris in this case re-

sembles closely the changes seen by Loewenstein and Foster. However, this case varies from theirs in other interesting respects. The fundus appearance is peculiar and suggests multiple ruptures of the choroid. If such is true it might be called choroidoschisis. The precipitates on the posterior surface of the cornea indicate that there has been cyclitis present. The localized lesions in choroid and iris suggest that similar lesions occurred in the ciliary body. These might not be apparent when only a small amount of ciliary body is examined gonioscopically. Lack of posterior synechias is of particular interest. Although it is known that the choroid and iris have been involved, and there is strong presumptive evidence that the ciliary body has also been affected, yet this brand of inflammation does not lead to synechias and does not lead to repair with fibrous tissue, but rather to localized areas of marked atrophy.

The relatively normal angles in this case are also of particular interest. Duke-Elder[3] has suggested that the cause of glaucoma in cases of essential atrophy of the iris is an extensive soldering of the root of the iris to the cornea, forming peripheral synechias. Loewenstein, Foster, and Sledge[2] have suggested that in iridoschisis the cause of the glaucoma is a blocking of the angle by pigment from the broken iris.

Neither of these possibilities can apply in this case. The open angle of the anterior chamber, the sudden and severe rises in tension, the lack of response to miotics and to operation, the presumptive evidence of cycloschisis all suggest that in this case the anomaly causing hypertension is an overproduction of aqueous.[4]

We might assume that patches of inflammation appear in the ciliary body. These correspond to the areas of iridoschisis and choroidoschisis and cause a marked overproduction of aqueous, a rise in intraocular pressure, and all the accompanying symptoms.

Summary

A case of iridoschisis and choroidoschisis is described. Periods of severe glaucoma occurred which were presumably due to overproduction of aqueous as the result of cycloschisis.

Medical Arts Building (5).

References

1. Loewenstein, A., and Foster, J.: Brit. J. Ophth., **30**:277 (May) 1945.
2. Loewenstein, A., Foster, J., and Sledge, S. K.: A further case of iridoschisis. Brit. J. Ophth., **32**: (Mar.) 1948.
3. Duke-Elder, W. S.: Textbook of Ophthalmology, St. Louis, Mosby, 1941, v. 3, p. 2406.
4. Posner, A., and Schlossman, A.: Recurrent unilateral glaucoma with mild cyclitic symptoms. Arch. Ophth., **39**:517 (Apr.) 1948.

NEVUS FLAMMEUS ASSOCIATED WITH GLAUCOMA*

HAROLD H. JOY, M.D.
Syracuse, New York

The occurrence of glaucoma in association with nevus flammeus is sufficiently uncommon as to warrant the report of all cases showing any unusual features, for such studies may be of assistance in solving the problems concerned with this syndrome.

Nevus flammeus is a congenital anomaly consisting of masses of telangiectatic vessels. It most frequently appears on the face over the area of distribution of one or more branches of the trigeminal nerve. It rarely extends beyond the midline and, when associated with glaucoma, involves the lids. Anderson[1] found that the upper lid was always affected. The nevus and the glaucoma are usually unilateral and almost always occur on the corresponding side of the face. Bilateral glaucoma almost never occurs unless the nevi are likewise bilateral. However, this does not necessarily predispose to involvement of both eyes, for bilateral nevi occur much more frequently than does bilateral glaucoma.

The nevus occasionally extends into the conjunctiva, and the conjunctival, episcleral, or retinal vessels are frequently enlarged or tortuous. As a rule, the iris is darker on the affected side and is often heterochromic, and occasionally telangiectases are present. The most typical intraocular vascular changes are anomalies of the choroid which, together with the occurrence of atrophic cupping of the optic disc, are characteristics of the syndrome.

Disorders of growth are sometimes associated with this condition. The most frequent manifestation is hypertrophy of the soft and bony tissues of the face on the side of the nevus.

As was first recognized by Sturge[2] 70 years ago, congenital vascular changes are not necessarily confined to the face and eye in these cases, but may also involve the brain. The anomaly consists of a meningeal angioma which frequently becomes calcified, and thus can be demonstrated roentgenographically. The resultant symptoms may vary considerably but most often consist of mental defects, epileptiform attacks, contralateral spastic hemiplegia or, more rarely, contralateral homonymous hemianopia. Occasionally, there is evidence of pituitary disease and none of any intracranial vascular disturbance.[3, 4] It has not been determined whether this is purely accidental or the result of some unidentified lesion interfering with the pituitary gland.[5] The occurrence of intracranial lesions is sufficiently frequent as to justify suspicion of their presence in all cases of facial nevus flammeus.

Nevus flammeus associated with glaucoma was first identified by Schirmer[6] in 1860. As only 15 additional cases were recorded in the next 60 years it was assumed that its occurrence was most unusual. However, that the condition is uncommon rather than rare is indicated by the fact that about 200 cases have been cited.

CASE REPORT

L. T., a white woman, aged 40 years, was first examined October 4, 1944. She complained of failing vision of the right eye during the preceding six months. She had occasionally noticed halos about lights but there had been no ocular pain or discomfort at any time. The family history and the past history were not significant. There was no history of convulsions, epileptiform seizures, or hemiplegia. She appeared intelligent and mentally alert. She had been admitted for hospital treatment on two occasions, first in 1923 for removal of the retained products

*Presented at the 85th annual meeting of The American Ophthalmological Society, Hot Springs, Virginia, June, 1949.

of conception, and again in 1929 for parturition. On the occasion of her first hospitalization the examination was quite complete. It revealed no abnormalities except for the presence of a hemangiomatous birthmark on the right side of the face, a cystocele, and a rectocele. There was no ocular complaint and external examination of the eyes revealed no abnormalities. The reflexes were normal and there were no neuromuscular defects.

Fig. 1 (Joy). Appearance of the patient.

Physical examination: Height, 63 inches. Weight, 110 pounds. General development and nutrition fair. A large purplish nevus flammeus occupied most of the right side of the face and forehead, including the lids. With the exception of several scattered, deeply pigmented moles there were no other blemishes of the skin. No defects were found in the nose, throat, and ears, and the mucous membranes of the mouth and throat were normal in appearance. A few teeth were carious and beginning pyorrhea was found about the lower incisors. Investigation of the heart, lungs, kidneys, spine, and extremities showed no significant changes and no abnormalities were revealed by neurologic examination.

Laboratory examination. There were 4,600,000 red blood cells, the centers of which were pale, and 8,600 white of which 77 percent were polymorphonuclear cells. The hemoglobin was 85 percent. The sedimentation time was over two hours. The urine was normal with a specific gravity of 10.20. The Wassermann reactions of the blood and spinal fluid were negative. X-ray examinations of the skull and orbit showed no defects.

Ophthalmologic examination. Vision in the right eye was 20/30, correctible to 20/20−, and vision in the left eye was 20/20. The tension in the right eye measured 30 mm. Hg and in the left 19 mm. Hg (Schiøtz). The exophthalmometer reading was 18 mm. right and left. Ocular motility was not impaired. The right field was concentrically contracted and the left field was normal.

The nevus flammeus which involved the skin of both the upper and lower lids of the right eye did not appear to extend beyond the lid margins. However, the palpebral conjunctiva was more red than that of the left eye. The conjunctival and episcleral vessels under the slitlamp appeared full and slightly tortuous but were not increased in number.

The globes seemed equal in size with a horizontal diameter of 13 mm. The corneas were clear and the anterior chambers were deep and equal. A gonioscopic examination was not made. The pupils measured four mm. in diameter and reacted well to light and near presentation, although the right pupil did not react quite as acutely as the left. The iris of the right eye appeared dark and dense.

Examination with the slitlamp revealed considerable vascularity, but the vessels did not appear to be dilated. Fine granules of brown pigment were scattered about in rather large amounts, and in some areas were markedly concentrated. The left iris presented a similar picture except that the

pigmentation was less pronounced and the vessels seemed to be smaller. However, this difference was so slight that it may have been more apparent than real. Both fundi appeared normal except for the right disc, which showed well-advanced glaucomatous cupping with parital atrophy. No abnormalities of the choroidal vessels could be observed.

The diagnosis was nevus flammeus associated with chronic noninflammatory adult glaucoma.

Clinical course. The tension was controlled by the use of miotics for about six weeks, but during the following month it gradually rose to 35 mm. Hg. Also the field defect, which up to this time had remained constant, began to show increasing contraction. Consequently, operative interference was advised and the patient was admitted to Memorial Hospital on December 17th.

Having been impressed by Dunphy's[7] report that in one of his cases the tension did not respond to the administration of dextrose solution, 50 cc. of a 50-percent solution was injected intravenously. The tension of the right eye, which measured 35 mm. Hg, was not lowered, whereas that of the left eye dropped from 19 mm. Hg to 15 mm. Hg one-half hour later.

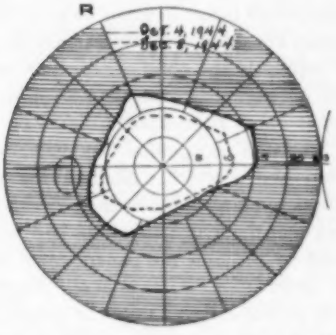


Fig. 2 (Joy). The visual field of the right eye was concentrically contracted.

An iridencleisis was done on the right eye on December 19th. Dr. A. B. Reese, who kindly consented to examine the excised iris tissue, reported that no pathologic lesions were present. There was no evidence of angiomatous or other changes which might indicate the cause of the glaucoma (fig. 3).

Fig. 3 (Joy). Microscopic appearance of excised iris tissue.

The patient made an uneventful recovery and was discharged from the hospital on the eighth postoperative day and was kept under observation until May 3, 1945. During this period the tension in the right eye ranged from 13 mm. to 15 mm. Hg and in the left eye from 17 mm. to 19 mm. Hg. When last examined, the vision in both eyes was the same as at the time of the first examination. The right field defect was little changed since shortly before the operation and the left field was still normal.

Comment

Buphthalmos and adult glaucoma

Nevus flammeus being a congenital condition, the glaucoma associated with it is

usually of the buphthalmic type. Such was found to be true in 68 percent of the cases reviewed by O'Brien and Porter.[8] In these cases, it is assumed that during prenatal life certain congenital defects have sufficiently developed to establish the glaucomatous process.[4, 9] In those cases in which the intraocular pressure does not become elevated until later in life, it has been suggested that the congenital predisposition is present but remains latent, and does not manifest itself until some senile vascular change or increase in intraocular telangiectasis upsets the balance in the exchange of the intraocular fluids.[4, 9]

On the other hand, Krause[10] attributed the late elevation in tension to disarrangement of the endocrine secretions following growth stimulation. Whatever the cause, the globe does not become enlarged and the condition resembles true primary or secondary glaucoma. Salus[11] was the first to call attention to the occurrence of adult glaucoma in association with nevus flammeus.

Optic atrophy with cupping

One of the characteristics of glaucoma associated with nevus flammeus is the occurrence of atrophy of the optic disc with cupping. It is generally assumed that this is caused by pressure on the lamina cribrosa as a direct result of the elevated intraocular pressure. However this condition may also occur in the presence of normal tension.[3, 8, 13–17]

It is a well known fact that this phenomenon is not confined to the nevus-glaucoma syndrome, for it sometimes occurs in true primary glaucoma. Many years ago, Schnabel[18] sought to explain this condition on the assumption that the involvement of the disc was the result of an essential lacunar atrophy of the optic nerve which was entirely independent of the intraocular pressure.

Several other theories have been advanced to account for this incongruity. The most generally accepted explanation seems to be that it is caused either by a preëxisting elevated tension which has returned to normal, or that the lamina cribrosa in these cases is for some unknown reason not strong enough to withstand normal tension. E. Fuchs,[19] who introduced the latter idea, suggested that the condition might be a combination of optic atrophy and simple glaucoma.

Elschnig[20] disagreed with Fuchs and suggested that the optic-nerve elements were destroyed by an abnormal action of the intraocular fluid as it passes through the nerve. Arnold Knapp[21] offered evidence that atrophy with cupping may be caused by impaired blood supply to the optic nerve resulting from arteriosclerotic changes in the nutrient blood vessels. Roentgen studies showed sclerosis of the larger arteries and is was assumed that the smaller vessels were likewise affected. Thiel[22] came to similar conclusions.

Impressed by Knapp's and Thiel's investigations, Evans and Evans[16] offered a similar explanation for its occurrence in those cases associated with facial nevus. According to their concept, the degenerative and sclerotic changes which occur in many cases of nevus flammeus are sufficient to embarrass the vascular supply to the optic nerve, thus resulting in its partial or complete atrophy. On the other hand, Ballantyne[5] believes the cupping to be a congenital anomaly, while O'Brien and Porter[8] explained the glaucomatous optic atrophy in their case by assuming that the hydrophthalmos had become arrested by the time the patient came under their observation. Grossmann[17] suggested that the lamina cribrosa might be congenitally weakened so that a tension which in normal individuals would not be considered elevated is sufficient to produce glaucomatous cupping.

Origin of vascular anomalies

The nevus-glaucoma syndrome, particularly if there is intracranial involvement, may be caused by lesions in many different combinations. Efforts have been made by various authors to explain the origin of these

anomalies on a common basis, and to trace back the cutaneous, ocular, and meningeal changes to a common origin.

It seems possible, as suggested by Safar,[23] Marchesani,[24] and others, that the congenital anomalies may be due to a defect in the germinal layers occurring in very early embryonic life. If such is the case, it would be necessary to assume, as maintained by Ballantyne,[6] that in some cases the initial disturbance may be more or less extensive, while in others it may be confined to one or more of the embryonic metameres. Whatever the cause, the congenital nevi must be due to some developmental defect in the capillaries of the part affected.

The tendency for the facial nevus to be limited by the distribution of one or more branches of the trigeminal nerve led Von Baerensprung,[25] in 1863, to introduce the nervous theory. Many years later Cushing[26] gave it his support in noting that in cases of intracranial hemorrhage associated with this condition, the affected area of the brain was also supplied by branches of the fifth nerve. The apparent regulation by the vasomotor nerves of the development and growth of the blood vessels suggested to Verhoeff[27] that early impairment of this influence might allow an abnormal growth of the vessels and thus form a nevus.

Larmande[28] has recently stated that he believes that the anomalies are caused by a hypothalamo-hypophyseal neuro-endocrine disturbance. This could account for the angiomatous lesions, increased capillary permeability, lack of vasomotor control, heterochromia of the iris, and the occurrence of facial hemihypertrophy. He concluded that two factors coexist. One, in which the lesion is probably in the hypothalamus, affects the sympathetic nerve, as manifested by heterochromia of the iris, and determines the topography of the vascular lesions. The other factor is an endocrine hypophyseal disturbance which explains the hemicranial facial acromegaly.

The occurrence of glaucoma in association with nevus flammeus has caused much speculation as to what actually produces the glaucomatous state. In many of these cases vascular ocular anomalies of one sort or another have been demonstrated clinically; and angiomatous changes of the choroid have been found in most of the few eyes which have been examined histologically. Consequently, it is quite generally agreed that these vascular changes, like the facial nevus, are congenital in origin and are concerned with the development of increased intraocular pressure.

Pathologic investigation

Dunphy,[7] Granstrom,[29] and Anderson[1] have summarized the findings in 19 eyes,* and the pathologic reports of three additional cases have been published.[30-32] The salient features common to most of the globes were dilatation of the intraocular capillaries, the presence of angiomatous changes of the choroid, and obstruction of the filtration angle. Complete detachment of the retina was usually present.

Omitting one case[33] in which only the iris was examined, angiomatous changes of the choroid were found in all but four of the globes. Cabannes,[34] Clausen,[35] Weber,[36] and Safar[23] stated that no vascular anomalies of the choroid were present in their specimens. Cabannes's case was so atypical that it can be eliminated from this discussion. But upon examining the records of the other three cases, Granstrom[29] insisted that undetected lesions may have been present. However, adequate proof of this contention is lacking.

It is possible that blocking of the filtration angle was present in more than the 12 eyes in which it was reported, for the condition of the anterior segment was not always described. However, in four eyes, the chamber

* Milles (1884), Lawford (1885), Snell (1886), Wagenmann (1900), Steffens (1902), Quackenboss and Verhoeff (1908), Stoewer (1908), Cabannes (1909), Love (1914), Paton and Collins (1919), Safar (1923), Knapp (1927), de Haas (1928), Clausen (1928), Weber (1929), Jahnke (1931), von Hippel (1931), Granstrom (1935), Dunphy (1935).

angle was found to be open.[29, 34-36] These include Cabannes's atypical case and the cases of Clausen and Weber in which the choroid was also normal.

Angioma of choroid and vascular theory

The frequent occurrence of angioma of the choroid in this syndrome is quite significant, for ordinarily it is a rare condition. Angiomas apparently tend to expand slowly, or possibly the enlargement may appear more suddenly as the result of turgescence.[1] Hence, in some cases its forward growth might block the filtration angle or its bulk alone might be sufficient to cause the increase in tension. However, little is known regarding tendencies of angiomas to increase in size, and it is doubtful if their effect can be compared with that of intraocular tumors, in which the growth is usually rapid and infiltrative.[29]

The vascular nature of the angioma together with its quite consistent association with glaucoma has led to the idea that the vascularity might be the essential factor in causing the rise in tension. This has occasioned the introduction of various vascular theories, most of which are based on the assumption that the primary seat of the trouble is in the choroid, which becomes repleted as the result of angiomatous changes. It is assumed that this leads to transudation of serous fluid through the large and numerous thin-walled veins together with consequent diminished outflow of the intraocular fluids that thus produces the elevation in tension.

Increased capillary permeability and plasmoid aqueous. Tyson[37] suggested that the rise in tension may be due to increased intraocular capillary permeability with resultant changes in the consistency of the aqueous, which causes blocking of the filtration angle. He reported that in his case the internal administration of fluorescein produced coloration of the aqueous in the affected eye while that of the other eye remained clear. He suggested that this was due to an increased permeability of the vessels in the glaucomatous eye. In view of the fact that gonioscopic examination had showed the iris angle to be clear, he concluded that the aqueous had undergone plasmoid changes which had caused it to block the filtration angle and thus produce the glaucoma.

Dunphy,[7] who was impressed by Tyson's suggestion, offered further evidence indicating the occurrence of increased permeability. He found that the intravenous injection of a 50-percent solution of dextrose did not affect the intraocular pressure in the glaucomatous eye, whereas ordinarily it is reduced because of the increased osmotic pressure of the blood. He concluded that there must have been a rapid exchange of the dextrose from the blood to the aqueous, resulting in a quick relative equalization of the respective osmotic pressures. The results in my patient tend to confirm his thesis, for the tension in the glaucomatous eye was unaffected by the dextrose injection while that of the normal eye fell from 19 mm. to 15 mm. Hg.

Although the results in these two cases are suggestive of increased capillary permeability, it is not impossible that the fall in tension was prevented by some unknown unrelated factor. There can be little doubt that the permeability was increased in Tyson's case. However, experiments demonstrating that pilocarpine increases the permeability of the blood-aqueous barrier to fluorescein cast some doubt as to the cause in this case,[38, 39] for Tyson stated that his patient received two-percent pilocarpine in the affected eye. But he did not indicate whether this treatment was being carried on at the time the fluorescein was administered. It is unfortunate that this test has not been used in cases in which this doubt could be eliminated. However, if it is found that the permeability for fluorescein is increased, it does not necessarily indicate the formation of a plasmoid aqueous, for there may not be a similar increase for the larger protein molecule.[40]

Dunphy[7] pointed out that any condition which tends to dilate the intraocular capil-

laries produces an increased protein content of the intraocular fluids. Although this is true, it has not been demonstrated that the dilatation found in this condition is sufficiently great to allow the molecules to pass through their walls.[40]

Unfortunately, little experimental investigation has been carried on to determine if the protein content of the aqueous is actually increased in this condition. Mehney[41] found an increase in his patient, and Imai[42] reported that the protein content after paracentesis was twice as great as that of the primary aqueous in the glaucomatous eye, whereas there was no difference whatever in the normal eye. However, too much credence cannot be placed on the results of such experiments. The amount of aqueous in the eye is so small as to make accurate analysis extremely uncertain. Mehney freely admitted this and expressed the belief that his results were inconclusive. As regards Imai's report, it is difficult to understand why he found no increase in the protein content of the secondary aqueous of the normal eye, whereas some investigators have found it to be 5 to 10 times as great.

It is apparent that clinical and experimental investigations have, so far, failed to confirm Tyson's theory. On the other hand, it has not been disproved, and there are other factors which indicate its feasibility.

It is probable that permeability of the blood-aqueous barrier sometimes plays an important part in glaucoma uncomplicated by nevus flammeus.[39] Moreover, it has been demonstrated in rabbits that a rise in intraocular pressure can be caused by increased capillary permeability associated with the formation of a plasmoid aqueous.[43] The occurrence of plasmoid changes would seem to be important for, according to Kinsey and Grant,[44] increased permeability without blocking of the filtration angle leads to lowering of the tension. It is their conception that the osmotic relationship between the blood and the aqueous is more or less eradicated so that the elements can pass freely in either direction.

Discussion

The clinical and histologic demonstration of an open filtration angle in some cases proves conclusively that something besides mechanical obstruction may be involved. The uniform presence of dilated capillaries, the frequent demonstration of angiomatous uveal anomalies, together with some evidence pointing to increased capillary permeability with consequent formation of a plasmoid aqueous, all indicate that disorganization of fluid traffic may play an important role, and sometimes the sole role, in the production of the glaucoma.

There can be little doubt that mechanical obstruction to the aqueous outflow is the major factor, and perhaps the only cause in most cases of buphthalmos. However, such anomalies are apparently of decreasing importance in later life, and by middle age or after play little or no part in causing increased intraocular pressure.[1] Consequently, excessive formation of the intraocular fluid, perhaps abetted by changes in its content, is probably chiefly responsible in causing late adult glaucoma. The apparent absence of lesions of the uvea in some cases indicates the possibility that increased permeability with consequent formation of a plasmoid aqueous may be capable of causing this alteration.

As the glaucoma in my case was of the adult type, it is unlikely that it was caused by an anomaly of the chamber angle. However, as facilities were not available for gonioscopic examination, this possibility cannot be eliminated. We do know that the angle was not blocked by angiomatous changes of the iris, for clinical and histologic examination showed no such anomalies, and the anterior chamber was deep. Vascular changes of the choroid are always most difficult to detect clinically, hence my failure to discover such a lesion does not necessarily indicate its absence. In this respect, one might speculate if angiomas occur as consistently in this condition as is indicated by histologic examination, for only hopeless eyes are subject to pathologic study, and those with such

changes may predominate in this group.

The only unusual feature in my case was the lack of response in the glaucomatous eye to the administration of dextrose solution. The fact that the vessels of the iris were not dilated does not exclude the likelihood of increased capillary permeability, for, according to Seidel,[65] this is determined by the state of the endothelium and not the size of the vessels. It must be acknowledged that some extraneous factor may have prevented the fall in tension. If this be true, my case adds nothing to our knowledge.

But, if it transpires that it occurs with any degree of regularity in this condition, the observation may possibly be of some importance. For, as pointed out by Dunphy, it would suggest an increased permeability of the blood-aqueous barrier. However, conclusions cannot be based on the effect of osmotic forces alone. Direct permeability tests with gonioscopy, together with further studies of the aqueous content, are essential to determine if this theory is tenable, for up to now there is little factual evidence to support the hypothesis.

If nothing else is accomplished by this report, it may stimulate such investigations, for the idea of increased capillary permeability with consequent formation of a plasmoid aqueous is most intriguing and is not incompatible with the vascular theory. Its acceptance would explain the development of glaucoma in the presence of a patent chamber angle whether or not vascular anomalies of the uvea were also present.

State Tower Building (2).

References

1. Anderson, J. R.: Hydrophthalmia or Congenital Glaucoma. London, Cambridge Univ. Press, 1939.
2. Sturge, W. A.: Tr. Clin. Soc. London, **12**:162, 1879.
3. Voegele, J.: Klin. Monatsbl. f. Augenh., **74**:775, 1925. Quoted by Ballantyne, A. J.: Brit. J. Ophth., **14**:481, 1930.
4. Ginzburg, G.: Klin. Monatsbl. f. Augenh., **76**:393, 1926. Quoted by Ballantyne, A. J.: Brit. J. Ophth., **14**:481, 1930.
5. Ballantyne, A. J.: Brit. J. Ophth., **14**:481, 1930.
6. Schirmer, R.: Arch. f. Ophth., **7**:119, 1860.
7. Dunphy, E. B.: Am. J. Ophth., **18**:709, 1935.
8. O'Brien, C. S., and Porter, W. C.: Arch. Ophth., **9**:714, 1933.
9. Hudelo, A.: Ann. d'ocul., **166**:889, 1929.
10. Krause, K.: Ztschr. f. Augenh., **68**:244, 1929.
11. Salus, R.: Klin. Monatsbl. f. Augenh., **71**:305, 1923.
12. Lowenstein, A.: Klin. Monatsbl. f. Augenh., **70**:540, 1923.
13. Bar, C.: Ztschr. f. Augenh., **57**:628, 1925.
14. MacRae, A.: Brit. J. Ophth., **13**:63, 1929.
15. Thompson, E.: Brit. J. Ophth., **13**:127, 1929.
16. Evans, J. J., and Evans, R. J.: Brit. J. Ophth., **23**:95, 1939.
17. Grossman, E. E.: Arch. Ophth., **33**:389, 1945.
18. Schnabel: Arch. f. Augenh., **24**:273, 1892.
19. Fuchs, E.: Ztschr. f. Augenh., **25**:108, 1911.
20. Elschnig, A.: Ztschr. f. Augenh., **52**:287, 1925.
21. Knapp, A.: Arch. Ophth., **8**:637, 1932.
22. Thiel: Ber. d. deutsch. ophth. Gesellsch., p. 133, 1930. Quoted by Evans, J. J., and Evans, R. J.: Brit. J. Ophth., **23**:95, 1939.
23. Safar, K.: Ztschr. f. Augenh., **51**:301, 1923.
24. Marchesani, O.: Wien. med. Wchnschr., **75**:2538, 1925.
25. Von Baerensprung: Ann. des Krankenhauses zu Berlin, Band 11, Heft 2, p. 91, 1863. Quoted by Love, J. M.: Arch. Ophth., **43**:607, 1914.
26. Cushing, H.: J.A.M.A., **47**:178, July 21, 1906.
27. Love, J. M.: Arch. Ophth., **43**:607, 1914.
28. Larmande, A. M.: La Neuro-Angiomatose Encephalo-Faciale, Syndrome Hypothalamo-Hypophysaire, Masson et Cie., Paris, 1948.
29. Granstrom, K. O.: Acta. Ophth., **13**:115, 1935.
30. Marlow, S. B.: Arch. Ophth., **57**:484, 1928. Histologic examination by F. H. Verhoeff.
31. Evans, P. J.: Arch. Ophth., **18**:193, 1937.

32. Ballantyne, A. J.: Brit. J. Ophth., **24**:65, 1940.
33. Knapp, A.: Tr. Am. Ophth. Soc., **25**:154, 1927.
34. Cabannes, C.: Arch.d'opht., **29**:368, 1909.
35. Clausen, W.: Klin. Monatsbl. f. Augenh., **81**:393, 1928.
36. Weber, Parkes: Proc. Roy. Soc. Med., Neurol. Sect., **22**:25, 1929.
37. Tyson, H. H.: Arch. Ophth., **8**:365, 1932.
38. Huber, A.: Ophthalmologica, **114**:217, 1947.
39. Stocker, F.: Arch. Ophth., **37**:583, 1947.
40. von Sallmann, L.: Personal communication.
41. Mehney, G.: Arch. Ophth., **17**:1018, 1937.
42. Imai, N.: Acta Soc. Ophth. Jap., **36**:114, 1932.
43. von Sallmann, L., and Dillon, B.: Am. J. Ophth., **30**:1244, 1947.
44. Kinsey, V., and Grant, W.: Brit. J. Ophth., **28**:351, 1944.
45. Seidel, E.: Arch. f. Ophth., **102**:366, 1920.

LYSOZYME IN THE TREATMENT OF OPHTHALMIC CONDITIONS

CARL HOBART, M.D.
St. Louis, Missouri

The incidence of ocular infection, in spite of the traumatic and potentially infected environment to which the delicate structures of the eyes are constantly exposed, is surprisingly low. As Thompson[1] has pointed out: (1) Infections after operation were relatively infrequent even before the principles of antiseptic and aseptic surgery had come into general use, (2) comparatively few organisms can be cultivated from the normal conjunctiva, and (3) organisms implanted in the conjunctival sac seldom grow.

The natural conclusion from these observations, which have long been commonplace, was that tears, through a possible bactericidal or inhibitory action, were in some way responsible for the relative freedom of the eyes from infection. Constant flushing of the ocular structures by the tears and winking of the eyelids were also assumed to play important roles.

It was not until 1922 that a valid explanation was advanced for the antibacterial properties apparently possessed by tears. In that year Fleming[2] showed that tears have the property of dissolving or lyzing certain saprophytic cocci rapidly and completely. In his experiments, some strains of staphylococci, some hemolytic and other streptococci, and some abortus bacilli were dissolved by tears diluted as much as 100 times. Microscopic solution of pneumococci, Brucella organisms, and influenza, diphtheria, and plague bacilli was not observed, though the apparent lack of results, as Thompson[1] emphasizes, does not necessarily indicate that these microörganisms were not affected. Other observers, including Thompson and Gallardo,[3] have since confirmed Fleming's original studies with tears.

REVIEW OF THE LITERATURE

Thompson's[1] comprehensive critical review of the early studies on the antibacterial action of tears makes unnecessary a similar review in this communication. Up to 1922, when Fleming's[2] studies were carried out, essentially the same methods were used by all observers: Varying inocula of different organisms were made into small volumes of diluted or undiluted tears and constant amounts of these mixtures were plated out at intervals during incubation. Killing and inhibition of organisms or absence of results (that is, growth of organisms) was determined by comparing the number of colonies present at the initial platings with the number present at later periods.

The results of the early workers, which Thompson[1] summarizes in detail, were contradictory, as might have been expected. Part of the difficulty unquestionably arose

from the small quantities in which tears are normally obtainable. The amounts are increased when factors of irritation are present, and early workers frequently yielded to the temptation and used for their studies tears obtained from subjects with pathologic conditions of the conjunctiva or cornea. The presence of disease, however, brings about changes in the constituents of the lacrimal secretion and studies made under such circumstances are not comparable to studies made on tears obtained from normal subjects.

Although for this and other reasons, the results of early workers were not always in agreement, the studies, as a general rule, showed that staphylococci, usually of the aureus strains, which were most frequently tested, were consistently killed, or were inhibited in various degrees, by tears. Fewer tests were made with other organisms, but the evidence suggested that enteric gram-negative organisms were not as consistently affected as were staphylococci.

Later studies by Ridley,[4] who used normal tears obtained by stimulation with lemon juice, and by Thompson and Gallardo,[5] who used normal tears obtained by onion vapor, are more conclusive. Ridley, in adequately controlled studies, inoculated dilutions of bacterial suspensions into tubes containing various concentrations of tears, to which 10-percent serum or peptone had been added to supply nourishment.

He found that staphylococci of the aureus strains, hemolytic and fecal streptococci, pneumococci and cholera vibrios were markedly inhibited by tears but that colon and typhoid bacilli were not affected.

Thompson and Gallardo, also in a properly controlled experiment, inoculated dilutions of suspensions of staphylococci into various tear dilutions added to equal parts of broth. They found that coagulase-negative strains of white staphylococci were completely inhibited by tear dilutions of 1:2 and 1:4 but that coagulase-positive orange strains, although they were inhibited by 1:2 dilutions, were not inhibited by 1:4 dilutions.

Lack of nutrition, Thompson and Gallardo pointed out, could have played no part in their results; growth always occurred in the equivalent broth-saline mixtures. The effect of dilutions in their studies was essentially the same as that reported by Ridley, who had observed that a slight decrease in the concentration of the tears could cause a complete loss of their antibacterial action. Pneumococci which could be killed at 90-percent concentration, for instance, lived when the concentration was reduced to 75 percent.

Nature and properties of lysozyme

Fleming's[2, 3] studies, which were begun in 1922, indicated that the agent concerned in the lysis of bacteria by tears is an enzyme, to which he gave the name lysozyme, that is, the lytic enzyme. Further studies showed that it is widely distributed. It appears in nasal mucus, sputum, cartilage, various tissue extracts, vegetable juices, and egg white. Canine tears contain considerable quantities, although the amount is less than that of human tears, but the tears of rabbits and cats contain only small quantities. A lysozyme-sensitive organism, Fleming showed, could be dissolved in one hour at 45°C. by blood serum in a concentration of 1:270; nasal mucus and sputum, in concentrations of 1:13,500; by saliva in a concentration of 1:300, and by tears in a concentration of 1:40,000. Leukocytes were found to contain lysozyme in the same concentration as tears.

The high concentration of lysozyme in egg white has made this substance a convenient source for the large amounts of material necessary for chemical and other studies of this enzyme and has made possible the building up of a fairly adequate store of knowledge concerning it.

Lysozyme[1, 4, 6] in its pure state is an amorphous yellow powder which is readily soluble in water and in physiologic salt solution. It is destroyed within a short time by

temperatures exceeding 75°C. but not by temperatures below 40°C. It is highly effective at body temperature and acts most rapidly at 60°C. If preserved at the proper temperature, it retains its potency for many months.

Lysozyme cannot be filtered in the ordinary way. When, however, the filter is saturated, the lytic enzyme can pass through unhindered. Lysozyme can be purified by dialysis since it will not pass through parchment or through collodion membranes. It is not destroyed by acetone, alcohol, ether, chloroform, or totulol, even after a considerable period of time, and these substances are therefore useful for the preservation of lysozyme-containing materials. A convenient method of preservation is to dehydrate the tissue with acetone and then allow it to dry. In its dry state it can be preserved for a long time.

Wolff's[6] studies on the chemical nature of lysozyme showed that it gives none of the reactions for protein and does not contain nitrogen, phosphate, phosphorus, or sulfur. It is fixed by lecithin and fats as an absorption compound, fixation of fats being the probable means of storage within the body. Wolff's studies also showed that no anaphylactic phenomena follow the injection of lysozyme. The only effect of subconjunctical injection is a slight redness, lasting about 24 hours.

The lysozyme titer of tears is always reduced in ocular infections. Ridley,[4] whose studies were made on patients with vitamin deficiencies, phlyctenular disease, interstitial keratitis, trachoma, and corneal ulcers, pointed out that in long-sustained epiphora the titer was reduced by as much as 30 to 60 percent. The reduction was observed even when there was little or no exudate or conjunctival congestion. Moreover, it was necessary for epiphora to last only a few hours to produce this result.

In 13 cases of ulcerative keratitis in Ridley's series the lytic enzyme was reduced from 1:400 to 1:600. In six cases of active corneal lesions associated with trachoma, in all of which epiphora was particularly marked, the titer was reduced from 1:200 to 1:800, though in 14 cases of trachoma in the chronic healed stage, in which epiphora was absent, the titer was within normal limits (1:600 to 1:12,800).

Further proof of the lower concentration of lysozyme in disease states was provided by Thompson and Gallardo.[3] They diluted tears collected by stimulation with onion vapor from 1:50 to 1:416, then doubled each dilution by adding to each tube an equal suspension of air sarcinae standardized and known to be susceptible to lysis. These tubes were incubated for an hour at 37.5°C. Seventy-three samples from normal subjects and 63 samples from patients with acute and chronic conjunctivitis and keratitis were studied according to this routine.

From normal eyes the highest dilution which caused complete solution of the microorganisms was 1:410 to 1:416. Only one of the 63 samples from diseased subjects, on the other hand, contained lysozyme in concentration equivalent to the concentration of the highest normal group, although 30 percent of all normal samples fell into this group. The majority of the pathologic samples were within the range of normal, it is true, but in 14 percent the concentration was definitely lower than that of samples from nondiseased eyes, and in 14 percent the concentration was lower than the concentration found in any normal sample. The concentration of lysozyme in acute conjunctivitis was lower than the concentration in chronic conjunctivitis.

Studies by Thompson and Gallardo,[3] in 1936, proved what up to this time had been assumed without proof, that the chief source of lysozyme in tears is the lacrimal glands rather than the mucous glands of the conjunctiva. They removed the lacrimal glands and conjunctivas from two anesthetized dogs and placed the tissues separately in acetone in the refrigerator. When the drying process was complete, the tissues were

weighed, ground, and suspended in saline solution to make a one-percent suspension of the dry weights. At the end of 24 hours they were centrifuged and the clear supernatant fluid was titrated for lysozyme content by the method described for tears.

In the first dog, the highest dilution of lacrimal-gland extract which caused complete lysis of sarcinae was 1:256; the highest dilution of extract of conjunctiva was 1:2. In the second dog, the highest dilution of lacrimal gland and of conjunctiva which produced this result were, respectively, 1:256 and 1:8. These results leave little doubt that the bulk of lysozyme in the tears originates in the lacrimal glands and not in the conjunctiva.

Therapeutic uses of lysozyme

In spite of the significant facts just outlined, very little attention seems to have been paid to possible therapeutic uses of lysozyme in ophthalmologic conditions. Ridley,[4] although he did not personally use the method, made the suggestion that egg white be given a clinical trial in the treatment of ocular infections. The suggestion is interesting in view of the fact that James[7] (cited by Thompson[1]) recorded in his history of ophthalmology numerous references to the use of egg white for this purpose beginning, in fact, with the earliest Roman and Anglo-Saxon periods. One has no way of knowing, as Thompson pointed out, whether egg white was any more useful than such remedies as "rain water caught on Ascension Day" but the possibility is nonetheless interesting.

The only reports in the literature dealing with the use of lysozyme (egg white) in ocular diseases are by Russian authors. The first report, by Melnik and Natanson,[8] in 1936, concerned 13 cases of dacryocystitis, with good results in six cases; 14 cases of corneal ulceration, with good results in seven (two patients were lost from observation and there were five frank failures); 15 instances of conjunctivitis—treatment produced no results in two acute cases but was successful in 6 of 10 chronic cases and in 1 of 3 subacute cases.

Melnik and Natanson[8] also reported 42 cases of blepharitis with fair to good results in 35. Three patients recovered without sequelae. The other 32 regarded themselves as cured; in the opinion of the authors the results in this group, while not unqualifiedly successful, certainly exceeded those achieved by other methods. Clinical improvement was almost immediate in that pain, burning, and itching were promptly relieved. The duration of the disease in these cases was from 1 to 10 years. Many will be inclined to agree with Melnik and Natanson that blepharitis is the true "crux ophthalmologorum" and that any method which offers an improvement in the therapy of this condition should be pursued further.

Biantovskaya,[9] in 1939, reported the results obtained with two preparations of lysozyme, both made from the white of hen's egg, in 75 clinical cases, including 32 cases of keratitis, 15 cases of conjunctivitis, 16 cases of blepharitis, and 12 cases of dacryocystitis.

The figures are somewhat difficult to follow in the translation available to me but there is no doubt of Biantovskaya's opinion of the method. In keratitis her results were not only "not brilliant" but were "manifestly negative"; improvement was observed in only seven of the 32 cases. In two cases of corneal ulceration, rapid resolution of the infiltration was observed after the application of lysozyme but perforation finally occurred. In the 15 cases of conjunctivitis, good results were thought to be obtained in "gonoblenorrhea" of the newborn (three cases) and in one case of pneumococcal conjunctivitis. There was no improvement in the remaining cases and one patient, who had an infection with Koch-Weeks rods, became worse. Good results were obtained in five of the 16 cases of blepharitis, but in the remaining cases improvement, if it occurred at all, was transitory. In all these diseases the analgesic effects of lysozyme, although ini-

tially good, were transitory, and in ulcerative processes there was no perceptible regeneration of tissue.

In two of the 12 cases of dacryocystitis in Biantovskaya's series no bacteria were isolated. In the remaining 10 cases, in all of which pneumococci were isolated (six times in pure form, three times in association with staphylococci and once in association with Morax-Axenfeld rods) lysis failed to occur after the use of lysozyme and the clinical results were correspondingly poor.

Biantovskaya mentioned, in her extensive study, a report by Averbakh[10] of 40 cases of suppurative and other types of keratitis in which lysozyme proved to be a powerful bactericide; results were best when the process was acute. The flora was not usually investigated, and Biantovskaya describes the author's optimistic conclusions as "somewhat surprising." Since the communication in question is not available to me, I am unable to comment on it.

Thompson[1] commented, quite correctly, that the results obtained with lysozyme by Melnik and Natanson,[8] while suggestive, were far from conclusive, if only because the patients were not adequately followed up. They seemed to him, however, to be sufficiently encouraging to warrant repetition of treatment by the egg-white method, as well as the use of concentrated lysozyme preparations and leukocytic enzymes, which are apparently more effective against pathogens than egg white. In view of Thompson and Gallardo's[3] later work, it would seem even more logical to employ preparations of the lacrimal gland, in which the highest concentrations of the enzyme are found.

The rationale of lysozyme therapy in ocular diseases is obvious: The concentration of the lytic enzyme is lowered in the presence of pathologic changes and it is logical to correct the deficit, and to replace the enzyme, moreover, in an even higher concentration than that in which it appears in nature. Furthermore, the use of lysozyme, which is a substance naturally present in the fluids and tissues of the eye, seems more logical than the use of drugs, many of which affect adversely the concentration of lysozyme.[11]

My own interest in the possibilities of lysozyme obtained from ocular structures as a therapeutic agent in diseases of the eye dates from 1936. The first preparation employed* was an aqueous extract of the lacrimal gland. Three and a half gm. of the extract were derived from 513 gm. of fresh beef lacrimal gland. One ounce of this preparation was filtered, using physiologic salt solution, and the residue was made into 10-percent lacrimal-gland ointment.

In April, 1940, a more potent product was obtained. Fresh beef lacrimal gland was minced finely and macerated with distilled water. The resulting aqueous extract was condensed and mixed with 10 volumes of acetone. The precipitate was collected, washed, and desiccated in vacuo at low temperature. The dry material, 10.5 gm. of which were derived from 400 gm. of fresh beef lacrimal gland, was powdered and made into 10-percent ointment, with a base of 2.5-percent tragacanth. Glycerine (five percent) and phenol (1:500) were added as preservatives. This ointment is a stable product which permits a considerable local concentration of lysozyme.

Routine of treatment

The plan of treatment is simple. Following the usual routine of history-taking and examination, lysozyme is instilled daily until the infection regresses. The first applications are made in the office. If, however, the therapeutic regimen is likely to be long continued or if for any reason daily office visits would work a hardship, the patient is provided with a tube of the ointment and is given instruc-

* The lacrimal-gland substance used in these cases was supplied by Armour and Company, whose director of clinical research, Dr. Frederic Fenger, has coöperated with me in every possible way since this work was begun in 1936. My thanks are also due to Mr. Frank C. Parisel, Ph.B., Ph.G. of the Metropolitan Pharmacy, St. Louis, who prepared the ointment used in these cases.

tions for its use. Office visits are thereafter made as necessary. Hot fomentations are applied three times daily, for 15 to 20 minutes at a time. Atropine sulfate (1 or 2 percent) is also prescribed. An occlusive dressing is used if it seems indicated.

The majority of patients are also given vitamin A, in the form of a multiple-vitamin preparation. The relationship between lysozyme and vitamin A remains to be clarified, but it is now well known that patients with certain ophthalmic conditions are likely to suffer from a vitamin-A deficiency and Findlay's[12] studies indicate that such a deficiency is associated with a fall in the lysozyme titer of tears.

Analysis of data

Lysozyme ointment was first used in my practice in July, 1937. Between that date and the present time it has been used in 62 cases. The small number is not due to any hesitancy in employing this agent or any lack of satisfaction with results, but entirely to the difficulty of obtaining the preparation in the necessary quantities. The only untoward reaction in any case was the smarting sensation which some patients complained of for a few minutes (never more than five) after the ointment had been applied.

Bacteriologic studies were made in many, but not in all, cases in this series. A large amount of work has been done in this field,[1] and the exigencies of a private practice frequently did not allow time for the work. In general, staphylococci were isolated in most of the cases thus studied; pneumococci were usually isolated from serpiginous ulcers.

One patient with a large corneal ulcer and secondary glaucoma following cataract extraction died of myocarditis during the course of treatment. Treatment intermittently over an eight-month period improved, but did not produce healing of, the ulcer; it did, however, keep the patient practically free from pain. In a second corneal ulcer (Case 8) enucleation was eventually necessary. With the exception of these two cases, the results of lysozyme therapy were satisfactory to excellent in the 62 cases of ocular conditions which make up this series, in the sense that pain was promptly relieved, tearing disappeared promptly, and healing of the lesion occurred, usually promptly, and usually in far less time than under other methods of treatment. No formal control series exists, but during the period in which these 62 cases were treated, several times the number of cases of each of the conditions were treated by routine measures because, as has been pointed out, the supply of lysozyme was inadequate for general use.

Each patient, before discharge, was submitted to a complete examination, including ophthalmoscopic examination. All but five of the 62 have been followed up, most of them having been examined personally. There has been no recurrence of the lesion in any instance, though one patient (Case 10) later developed a similar lesion in the other eye. His prompt return for treatment, because of rapid healing of the earlier lesion, is testimony to the comfort experienced by patients while this method is being used.

The 62 cases in which lysozyme was used between July, 1937, and the date of writing (November, 1947) include the following groups:

Corneal ulcer (17 cases). Three cases were of the serpiginous type. The age range of the patients was 14 to 72 years. The duration of the lesion was from three days to 46 days, except for a single patient whose lesion had apparently been present for several months; in three instances the lesions were recurrent. The circumference of the ulcers ranged from 1 to 6 mm.; the majority were 4 to 5 mm. Possible etiologic factors included sinus disease in two cases, and an upper respiratory infection, herpes labialis, and an injury from a foreign body (several months earlier) in one case each.

Four patients had been treated by standard methods (including penicillin in two cases) for periods varying from 7 to 11 days and had proved unresponsive to them.

In all cases except the two in which results, as previously mentioned, were not satisfactory, healing of the ulcer was complete in from 3 to 24 days; in all but a few cases it occurred within a week, usually without serious impairment of vision.

Corneal ulcer associated with trachoma (seven cases). The age range of the patients in this group was 34 to 65 years; four were between 60 and 65. The duration of the trachoma was from 6 to 24 years and vision was already more or less seriously impaired in every case; every patient presented opacities. The ulcers, which were bilateral in every instance, had been present from two days to four months. All were 4 to 5 mm. in circumference. Standard measures of treatment had been employed without response, in five of the seven cases, for periods varying from 1 to 40 days. Following the application of lysozyme, healing occurred in from 5 to 14 days in six cases, and in 29 days in the seventh case.

Keratitis (seven cases). The age range of the patients was 23 to 54 years, and the duration of the lesion was from 4 to 21 days. Possible initiating causes included upper respiratory infections in three cases, dental infection in one, and exposure of the eyeball in one (Case 9). Healing under lysozyme therapy occurred in from 5 to 14 days in every case, and every patient had essentially normal vision when discharged.

Traumatic lesions (eight cases). The age range in this group was 15 to 53 years. The source of the lesion was a blow in two cases, a twig in two, and stone, wood, ashes, and cement in one case each. The accident had usually occurred from a few hours to 48 hours before the patient was seen but in one instance had occurred 27 days earlier. The lesion varied from 2 to 5 mm. in circumference. Healing under lysozyme therapy occurred in from 4 to 36 days; in all but two cases it occurred within the week. Vision was essentially normal in every patient on discharge.

Corneal foreign bodies (five cases). The age range of the patients was 25 to 56 years. In every case the accident had occurred from 24 to 48 hours before the patients were seen. All the objects were in the cornea and all were removed with slight to moderate difficulty. Healing occurred in every instance within 3 or 4 days, leaving the patients with essentially normal vision.

Burns (five cases). The age range in this group was 26 to 52 years. The accident had occurred from 1 to 24 hours before the patients were seen. Four were first degree, and one, in a patient with trachoma, was second degree. The causative agents were fresh plaster in two cases, and lime, hot grease, and battery fluid in one case each. Healing occurred in from 6 to 9 days in four patients and in 17 days in the fifth patient. Visual acuity was normal in all patients except the one with trachoma, whose vision was already impaired.

Dacryocystitis (four cases). The age range in this group was 32 to 59 years. The duration of the lesion was from two weeks to four months in three patients and was six months in the fourth. A thick discharge was present in every case, every patient had severe conjunctivitis, and every patient had been previously treated by other methods without success. Two patients were cured within seven days. The third was treated over a four-month period and the fourth for 11 months. In both of the latter cases discomfort, tearing, and thick discharge were promptly relieved, but a scant, watery discharge persisted for some time longer.

Conjunctivitis (four cases). The age range of the patients was 33 to 54 years and the duration of the lesion from 3 to 6 days. One patient had hay fever. Blepharitis was present in one case and iritis was developing in another. Healing occurred in from 5 to 15 days in all four cases. In every instance there was prompt relief of the tearing and discharge.

Miscellaneous infection (five cases). Two patients in this group, 22 and 24 years of age, respectively, had infected hordeola

which had developed 3 and 4 days earlier. Both healed completely in five days. A 24-year-old patient had a pinguecula which had been infected for six days; healing occurred in five days.

A 32-year-old patient with an infected pterygium was seen six days after infection had developed; healing was complete in eight days.

A 51-year-old patient with chronic glaucoma was first seen when intraocular pressure in the right eye was 97 mm. Hg (Schiøtz). She was suffering extreme pain, which had not been relieved by the use of miotics and other standard measures. Circumcorneal injection was marked and ulceration was feared. She was treated with lysozyme over a seven-month period. Pain was promptly relieved, and no ulcer or keratitis developed during the period of observation, though intraocular pressure remained high over the entire time.

Summary and Conclusions

Lysozyme, a constituent of various tissues and fluids of the body, is so named because of its lytic action on various bacteria. Its presence in tears is the explanation of their apparent bactericidal properties. Its chief source in tears is the tissues of the lacrimal gland. It appears in tears in reduced concentration in disease states.

Although the therapeutic use of lysozyme in ocular infections is obviously logical, only 3 or 4 studies, in all of which preparations of egg white were used, have been reported. Results, for the most part, were encouraging but not conclusive.

There is reported in this communication a series of 62 cases of ocular infection in which lysozyme was used in the form of a preparation derived from beef lacrimal gland. The conditions treated included corneal ulcer, in some instances associated with trachoma, keratitis, traumatic lesions, lesions arising from corneal foreign bodies, burns, dacryocystitis, and miscellaneous infections. Immediate and long-term results were fair to excellent in all but two of the 62 cases.

The results in this small series indicate that lysozyme is a rational method of treating various ocular infections and one which warrants further clinical trial.

3601A Gravois Avenue (16).

References

1. Thompson, R.: Lysozyme and the antibacterial properties of tears. Arch. Ophth., **25**:491, 1941.
2. Fleming, A.: On a remarkable bacteriolytic element found in tissues and secretions. Proc. Roy. Soc. Med., **93**:306, 1921-1922.
3. Thompson, R., and Gallardo, E.: The concentration of lysozyme in the tears in acute and chronic conjunctivitis: With a note on the source of lysozyme of tears. Am. J. Ophth., **19**:684, 1936.
4. Ridley, F.: Lysozyme: An antibacterial body present in great concentration in tears, and its relation to infection of the human eye. Proc. Roy. Soc. Med., **21**:1495, 1928.
5. Fleming, A.: Lysozyme. Proc. Roy. Soc. Med., **26**:71, 1932.
6. Wolff, L. K.: Cited by Thompson[1] and Ridley.[4]
7. James, R. R.: Cited by Thompson.[1]
8. Melnik, M., and Natanson, D.: Lysozyme in ophthalmic maladies. Bull. Inst. Metchnikoff, no. 2, 1936, p. 85.
9. Biantovskaya, E. Y.: Experiments in the application of lysozyme in ophthalmic practice. Vestnik oftal., **14**:44, 1939.
10. Averbakh: Cited by Biantovskaya.[9]
11. Harrison, W. J.: Ocular Therapeutics. Springfield, Ill., Thomas, 1947.
12. Findlay, G. M.: Aetiology of experimental keratomalacia. Brit. J. Exper. Path., **6**:16, 1925.

PERIPHERAL CHOROIDITIS SIMULATING RETROLENTAL FIBROPLASIA*

R. D. Harley, M.D., and R. W. Mather, M.D.
Atlantic City, New Jersey

One of the more complex problems confronting ophthalmologists today is that of retrolental fibroplasia. Authorities have not attained agreement on the etiology or classification of the group of entities which are characterized by the presence of abnormal tissue posterior to the lens. However, much information has become available recently through the efforts of very able authors.[1-4,9]

Since the mechanism by which these abnormalities are brought about remains unknown, it is not surprising that the differential diagnostic problems presented by these cases are complex. It is the purpose of this report to record our experience with a case which, although not identical with the condition described by Owens and Owens[2] and Reese[3] closely simulated the cases they describe.

While making routine studies of patients with potential cases of retrolental fibroplasia, the following case of unusual interest was encountered. It provoked interest not only because of the similarity of the condition to retrolental fibroplasia but because it is probably one of the earliest cases of its kind to come to autopsy.

Case report

A premature Negro female infant was born on October 13, 1948, after seven months' gestation. Her birth weight was 1,336 gm. (2 lbs. 15¼ oz.). Since there was a possibility that this child might develop retrolental fibroplasia, an ocular examination was performed.

Examination of the eyes one month after birth gave negative external findings. The infant was able to follow a light with each eye. The pupils reacted to light. Neosynephrin (10 percent) dilated the pupils to six mm. The media and fundi were normal.

Two weeks later the eyes were reëxamined with fully dilated pupils. The optic discs were of normal color for an infant, with clearly defined margins. The veins and arterioles appeared normal except in the extreme superior temporal periphery where they were darkened in color. There was a clear-cut grayish elevation of the retina in the superior and superior-temporal portion of the fundus of each eye. The elevations measured approximately six diopters in each eye. The remainder of the fundi was normal and there were no hemorrhages or exudates. The vitreous was clear. The remainder of the ocular examination was negative.

Since these grayish elevations of the periphery were the same as those described by Owens and Owens, the presence of early retrolental fibroplasia was suspected. However, we were unable to demonstrate any marked degree of vasodilatation, such as they described as appearing early in their cases.

The infant was referred to Temple University Hospital for study on December 2, 1948. At seven weeks of age it was noted that the elevated mass had extended to involve the entire periphery of each retina. The veins now appeared moderately dilated but no definite change was noted in the arterioles. No abnormalities of the vitreous were noted. No dentate processes of the ciliary body were seen and no membrane had as yet developed in the retrolental space. The child continued to be able to follow light.

The degree of elevation was recorded as follows:

Right eye

	(diopters)
Superior temporal	8–10
Superior nasal	8
Inferior temporal	5
Inferior nasal	5

* From the Department of Ophthalmology of Temple University Medical School. Read before the Eye Section of the Philadelphia County Medical Society, March, 1949.

Left eye	
Superior temporal	8
Superior nasal	8
Inferior temporal	3-5
Inferior nasal	3-5

At the time of admission the physical examination by the Pediatric Department was noted as follows: The child weighed 4 lbs. 15 oz.

Routine laboratory studies showed an anemia: 2.76, R.B.C., and 7.9 gm. hemoglobin. The blood serology was strongly positive and repeated tests (Kolmer, Kahn, Mazzini) were all positive.

The mother's Wassermann test was negative and a repeated test was reported anticomplementary. A blood transfusion to the child brought the hemoglobin to 8.5 gm. Two weeks after admission to the hospital the infant developed a diffuse pneumonitis. In spite of intensive chemotherapy, the temperature rose to 105° F, and the child died on December 23, 1949.

An autopsy was performed and the positive findings were confined to the lungs, long bones, and eyes. Histologic diagnosis of the lung tissue revealed peribronchitis and interstitial pneumonitis of the giant-cell type. Histologic diagnosis of the long bones was minimal epiphysitis.

Pathologic study of eyes. Both eyes were removed at autopsy and the pathologic description was: The entire periphery of the choroid was the site of an acute inflammatory process. Lymphocytes, plasma cells, large mononuclear, and epithelioid cells were present. The lymphocytes were of various ages and no polymorphonuclear cells were present. No necrosis was present and the epithelioid cells were beginning to group themselves, suggesting development into subsequent giant cells although no typical ones were found.

The involved peripheral choroid was considerably thickened as compared with the rest of the choroid. Many of the vessels of the choroid had thickened walls such as is seen in perivascular infiltrations. Albuminous retinal fluid was present but the pigment epithelium was everywhere intact and the retina was not involved by the inflammation. An occasional cell of possible inflammatory origin was seen in the iris. The vitreous, cornea, and sclera were normal for an infant. The angle was open and the canal of Schlemm was present.

Fig. 1 (Harley and Mather). Low-power section of choroid in region of equator, showing a thickened choroid and extensive cellular infiltration.

Diagnosis. Acute, serous, peripheral choroiditis, bilateral, probably of syphilitic origin.

Comment. In the literature on congenital syphilitic choroiditis, the descriptions are usually concerned with the

late, healed stage. This histopathologic description probably represents an extremely early case of congenital syphilitic choroiditis.

Discussion

This case simulated the early clinical appearance of retrolental fibroplasia because: (1) The prematurity and birth weight were in a range that has been shown by Terry[1] and Owens[2] to result in the highest percentage of cases of retrolental fibroplasia; (2) there were no fundal lesions one month after birth; (3) a grayish white, peripheral, elevated lesion developed in both fundi about the sixth postnatal week; (4) the veins were moderately dilated.

Although a case of peripheral leutic choroiditis in the newborn may resemble retrolental fibroplasia clinically, the pathogenesis offers easy differentiation. In retrolental fibroplasia, there is frequent association with multiple angiomas and the presence of angioplastic tissue behind the lens has been shown (Reese,[3] Klien[4]).

The neovascular formations, hemorrhages, and the organization of hemorrhage accounts for the retinal detachment and abnormal tissue. In the case reported the grayish peripheral detachment and other abnormalities developed from a serous inflammatory process.

In view of the negative history and serology of the mother, the uncertainties involved in the serology of the newborn, and the peculiarities of syphilis in general, it occurred to us that cases similar to the one herein reported could be expected.

Many authors attest to the uncertainties of both positive and negative tests up to two months of age. Cooke and Jeans[5] found that syphilitic infants at birth have a negative blood Wassermann reaction in 37 percent, weakly positive in 18 percent, and strongly positive in 45 percent. Many of these negative Wassermann tests became positive in two months but some of the positive tests became negative by the end of the first month,

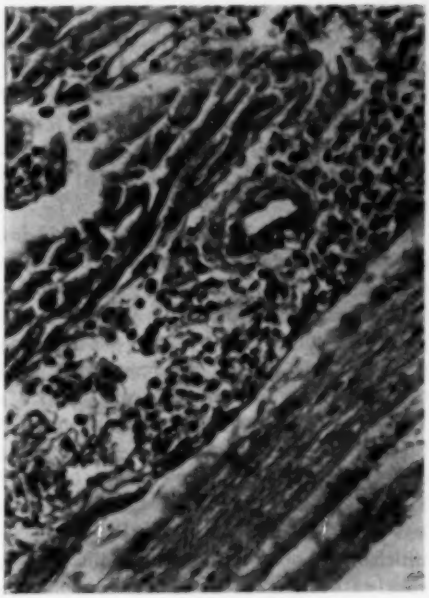


Fig. 2 (Harley and Mather). High-power section of choroid, showing an acute inflammatory process, thickened vessel wall, and presence of lymphocytes, plasma cells, large mononuclears, and epithelioid cells.

emphasizing the need for repeated tests.

Stokes[6] found in his studies that 21 percent of the mothers of syphilitic children showed negative reactions to the ordinary clinical and serologic examinations.

Syphilis has long been known as a likely cause of prematurity and of ocular lesions. Williams and Dallas[7] have shown that in 85 pregnancies in which the syphilitic mother received no treatment 28 percent of the births were alive but premature. Stokes found, in a large series of congenital syphilitics, that 78 percent had eye lesions and of these eight percent were choroiditis.

Reese and Payne,[8] in a discussion of the etiology of retrolental fibroplasia, suggested that the same factor which precipitates early birth may cause the eye lesion. They were referring to the association of maternal rubella with congenital anomalies in the offspring

and subclinical maternal toxoplasmosis associated with choroiditis in the offspring. One of their cases was that of a premature boy whose right eye showed persistence and hyperplasia of the primary vitreous. The left eye, of normal size, showed an area of juxtapapillary choroiditis not unlike that caused by toxoplasma.

All this accumulated evidence clearly indicates the difficulties encountered in the interpretation of the serologic tests for syphilis in the newborn. It also indicates the possibility that, although the mother shows negative serologic tests, her premature infant may be heavily infected with the disease.

A negative serologic report for the mother is of considerable significance since it definitely allays suspicion and makes one less likely adequately to check on the infant. Unless routine tests are made on the newborn, which is not a common practice, the disease could easily escape detection until lesions develop that demand complete investigation and treatment. From a purely clinical aspect, the eye findings in the early stages of detachment might prove hard to differentiate. Awareness on the part of the ophthalmologist of the presence or absence of syphilis in the mother or infant or both will aid in recognizing the true lesion.

In our case one must assume that maternal syphilis was a factor which precipitated the premature birth and caused the eye lesions. The report of the negative serology of the mother offered a pitfall in the early recognition of the infant's eye disease.

It seems unlikely perhaps that the presence of luetic choroiditis in the premature could be confused with retrolental fibroplasia. However, it does seem likely that the early stages of both diseases could resemble each other clinically.

In view of the fact that the clinical history and course of the disease simulated the early stages of retrolental fibroplasia we feel that syphilis must always be considered in the differential diagnosis.

Summary

1. This case report concerns a premature infant in whom the diagnosis of a bilateral retrolental fibroplasia was strongly suspected. On further study and on post-mortem examination, however, the condition proved to be a massive, serous, peripheral choroiditis of probable syphilitic origin.

2. The negative serology of the mother offered a pitfall in the early recognition of the infant's eye disease.

3. Difficulties encountered in the interpretation of serologic tests for syphilis in the newborn are given.

4. Massive peripheral serous separation of the retina is described as an early acute phase of congenital syphilitic choroiditis.

5. Since the clinical history and course of the disease simulated the early stages of retrolental fibroplasia we feel that syphilis must always be considered in the differential diagnosis.

101 South Indiana Avenue.

References

1. Terry, T. L.: Retrolental fibroplasia in the premature infant: V. Further studies on fibroplastic overgrowth of the presistent tunica vasculosa lentis. Tr. Am. Ophth. Soc., **42**:383, 1944; Arch. Ophth., **33**:203, 1945.

2. Owens, W. C., and Owens, E. U.: Retrolental fibroplasia. Am. J. Ophth., **32**:1, 1949.

3. Reese, A. B.: Persistence and hyperplasia of primary vitreous: Retrolental fibroplasia. Arch. Ophth., **41**:527, 1949.

4. Klien, B. A.: Histopathologic aspects of retrolental fibroplasia. Arch. Ophth., **41**:553, 1949.

5. Cooke and Jeans: Quoted by Stokes, J. H.: Modern Clinical Syphilology, Philadelphia, Saunders, 1934, p. 1229.

6. Stokes, J. H.: Ibid., p. 1219.

7. Williams and Dallas: Quoted by Stokes, J. H.: Ibid., p. 1274.

8. Reese, A. B. and Payne, B. F.: Persistence of primary vitreous. Am. J. Ophth., **29**:1, 1946.

9. Krause, A. C.: Congenital encephalo-ophthalmic dysplasia. Arch. Ophth., **36**:387, 1946.

RETARDATION OF WOUND HEALING IN THE CORNEAL EPITHELIUM BY LANOLIN*

JOHANNA C. HEEREMA,† M.D.
Cape Town, South Africa
AND
JONAS S. FRIEDENWALD, M.D.
Baltimore, Maryland

Retardation in the healing of corneal abrasions by the local application of various ointments have been reported by Smelser and Ozanics,[1, 2] Berens, de Gara, and Loutfallah,[3] and Leopold and Steele.[4] All of these authors came to the conclusion that the retarding effect was due to the ointment bases, most of which included lanolin as a component. These authors have used as their test injuries macroscopic abrasions one or more millimeters in diameter.

Friedenwald and Buschke[5, 6] have developed the technique of studying the healing of minute pinprick injuries in the rat's corneal epithelium, and have shown that the healing of such minute injuries is a somewhat simpler process, more regular in its time course than the healing of larger abrasions. Since these minute injuries normally heal within about three hours, the complicating effects of accidental infection and of inflammatory reactions are reduced to a minimum.

The present study was undertaken to find out whether the healing of such minute wounds was also retarded by the local application of ophthalmic ointment bases, and, if this proved to be the case, to use this more refined technique for an analysis of the cause of the retardation.

MATERIALS AND METHODS

U.S.P. lanolin and U.S.P. petrolatum album were used in these experiments. Albino rats of between 100 and 150 gm. weight were used. Each animal was put in an individual cage to prevent removal of ointment by cage mates. Whiskers were cut off so that ointment could not be dispersed or eaten. The legs on the side where the ointment base was applied (single or double according to the experiment) were strapped to the animals' sides with adhesive plaster in such a way that the animals could move, but were unable to wipe the ointment out of their eyes. The ointment bases were applied in excess and the animals held for one minute after application to be sure that the conjunctival sac was well filled.[2] The animals were observed at regular intervals to see whether any residuum was still present. It was found that lanolin, after a few applications at short intervals, could then be administered hourly. With this method of application, the cornea was, in most instances, found to be covered continuously with a more or less thick film of ointment. Petrolatum was less well retained in the conjunctival sac and had to be applied every half hour.‡

The ointment bases were applied respectively at hourly or half-hourly intervals for eight hours before the pinpricks were made. At the end of this pretreatment period, minute epithelial defects were produced in the cornea under ether narcosis in the way previously described[5, 6] with this difference that the holes were slightly larger and more numerous. The eyes were filled with ointment directly afterward, and then every 20 minutes for one hour. Treatment was then discontinued. One or two hours after ces-

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University. This work was supported in part by a grant from the American Cancer Society.

† Fellow in residence at the Wilmer Ophthalmological Institute, 1948.

‡ Lanolin appeared to be less well tolerated than petrolatum, as there was always some blepharospasm on the side on which it was applied.

sation of treatment—depending upon the stage of wound healing to be examined—the animals were killed by decapitation and the eyes enucleated.

At the time of autopsy, the amount of ointment base present in the conjunctival sac was always noted and sometimes a surprising amount was found, both of lanolin and of petrolatum. The eyes were fixed in formalin-alcohol and stained flat preparations were made with the technique previously described.[6] Two preparations were made of each cornea: a meridional band, 1.1 mm. wide, was cut out along the greatest meridian of the cornea, and an adjacent peripheral one of crescent form of more or less the same area.

In the first series of experiments, only one eye was treated with ointment and the other used as a control. In the second series of experiments, the effect of one ointment base in one eye was compared with that of another in the second eye or the same ointment base was applied bilaterally.

To test the effect of mechanical manipulations on the cornea, a few experiments were conducted in which a glass rod was rolled four times backward and forward over the cornea at the same intervals as petrolatum was applied. The mechanical insult inflicted in this way was much greater than that brought about by the gentle and careful application of ointment, where the cornea itself was not touched.

Results

Observation 1½, 2, and 3 hours after injury in eyes treated with lanolin as compared with untreated controls. Preparations made of untreated corneas, two hours after stippling, all showed the usual two-hour stages of wound healing as previously described.[5] The cell nuclei around the holes had without exception changed from the tangential primary position, were radially reoriented, and the migrating cells had partially or completely covered the floor of the holes.

In all cases in which lanolin had been applied, however, the picture was different. A great variety of stages of wound healing was found. Epithelial movements had not yet begun in several instances; in fact, holes were found, which were still completely empty, presenting the picture of fresh lesions. These were found side by side with holes, the floor of which was just covered, as in the late two-hour stages, and with holes in transitional stages.

In an attempt to collect more data about a possible prolonged initial lag period of epithelial movements, eyes were enucleated one and one-half hours after stippling and examined. In some instances, as has already been mentioned, the lag period was prolonged, but again all stages of wound healing occurred, from the earliest up to the stages corresponding to the normal reaction at this time after stippling.

A still greater divergency of stages of wound healing occurred in the eyes enucleated three hours after stippling. Completely empty holes were not observed but many holes were present, still in the condition of wound healing ordinarily found one hour after infliction of the injury, where tangential arrangement of the marginal cells was still preserved and where the radial epithelial reorientation had not yet started. These were seen next to all kinds of transitional stages of wound healing and next to completely covered holes of the normal three-hour stage, showing the characteristic stellar arrangement of the dark basophilic nuclei, a sign that the cells had completed their migration and were as closely approximated as possible.

The distribution of stages of wound healing in preparations of eyes of different animals varied strikingly, and a great variation of combinations was observed, apparently without any rule. Many very early forms could occur in one slide, as compared with none or only a few in another.

There was not only a variation from animal to animal. Between the two preparations

of the same eye a similar incongruity and a similar variation in the amount and combination of closed and uncovered defects, and defects in a transitional stage of wound healing might exist. In some cases the middle section would carry more advanced stages than the peripheral crescent; whereas, in other instances, the periphery possessed more progressed forms. It was evident that lanolin not only disturbed the normal course of wound healing but did so in an irregular fashion.

In Tables 1 and 2, the results of these experiments are presented, using the method previously described[5] to calculate the percent of healing. Every specimen in the lanolin-treated series showed some retardation of the healing process. The great difference in percentages of healing that can exist in two preparations of the same eye is evidence of the variability of this effect but, since the figures give the average state of healing of many wounds in any single specimen, the striking variability in the healing of different wounds in the same cornea is not indicated in the table. In any individual untreated eye, however, variations between different wounds was always between narrow limits.

Observations 2 and 3 hours after injury in eyes treated with petrolatum as compared with untreated controls. In this category of eyes treated with petrolatum and enucleated two hours after stippling, very early stages of wound healing were also noticed. Only two such specimens were examined. In the eyes enucleated three hours after stippling, on close observation a similar picture was found as in preparations of corneas treated with lanolin. The disturbance, however, was far less conspicuous. There were quite a number of slides in which not a single early stage was present, and where no difference existed between the treated and the untreated side. Only 10 out of 36 preparations showed some individual wounds in the very early stages of wound healing where migration had either not started or was just beginning. In contradistinction to the effect caused by lanolin, the percentage of early forms was very low while the percentage of the completely covered holes was high. There was

TABLE 1

EPITHELIAL MOVEMENT IN VIVO. ONE EYE TREATED WITH AN OINTMENT BASE, CONTROL EYE UNTREATED

Time after Injury (1½ hr.)		Time after Injury (2 hr.)			
L.E. Untreated	R.E. Lanolin	L.E. Untreated	R.E. Lanolin	L.E. Untreated	R.E. Petrolatum
%	%	%	%	%	%
17	4	50	14	61	50
16	9	67	22	67	67
17	17	77	20	56	50
14	8	60	12	59	36
24	19	65	22		
25	18	63	25		
		56	26		
		54	23		
		57	31		
		60	30		

Brief ether narcosis was administered in all the cases for stippling of the cornea. This holds for all the following experiments. Accolades indicate two sections of one eye; middle section is always put on top. When there is but one figure, only one preparation was made. The numbers represent the average degree of healing of all the wounds in each specimen calculated according to the method previously described.[5,6]

TABLE 2

EPITHELIAL MOVEMENT IN VIVO. ONE EYE TREATED WITH AN OINTMENT BASE, CONTROL EYE UNTREATED

Time after Injury (3 hr.)					
L.E. Untreated	R.E. Lanolin	L.E. Untreated	R.E. Petrolatum	L.E. Untreated	R.E. Washed Lanolin
%	%	%	%	%	%
100	57	100	100	93	96
92	45	100	100	92	94
100	62	98	98	100	100
100	50	94	94	93	96
85	67	87	69	94	94
90	60	100	70	100	94
100	61	100	100	100	86
87	43	100	90	95	95
83	45	97	75	95	73
83	79			91	66
94	47	94	96	100	94
95	61	100	94	100	100
100	67	80	67	82	80
		92	72	95	95
98	91	100	84	85	84
96	70	100	100	93	93
91	50	94	90	92	92
96	71	90	73	100	100
94	87	94	79		
100	75	100	95		
97	85	100	89		
100	97	94	96		
100	56	100	80		
		100	90		
92	73	98	92		
93	75	100	100		
93	62	100	100		
94	82				
90	56	90	90		
86	52	97	94		
100	50	91	75		
100	72	100	74		
100	67	78	70		
92	52	79	82		
		85	70		
		96	86		
		72	69		
Average 96	65	94	86	95	91

occasionally a discrepancy in degree of healing between the central and peripheral corneal sections, in which either of the two might be more retarded than the other. This happened in a far smaller number of cases and the difference was for the most part far less pronounced than in eyes treated with lanolin.

Wound healing in eyes unilaterally treated with petrolatum was, therefore, irregularly inhibited, but the inhibition produced by petrolatum was much less than that produced by lanolin. The average state of healing in each specimen is given in Tables 1 and 2.

Observations three hours after stippling in eyes rubbed with a glass rod. It appeared that rubbing did not have any effect on epithelization; in the rubbed corneas migration was completely within normal limits (table 5).

Observations 2 and 3 hours after stippling in cases in which both eyes were treated with an ointment base. Ointment bases applied simultaneously to both eyes gave results concurring with the preceding experiments. Slides made from cases treated with lanolin in one eye and another ointment base in the other presented the same picture as has already been described with respect to the lanolin, and so did a mixture of lanolin and petrolatum. Petrolatum, used bilaterally, disturbed migration in both eyes slightly but distinctly, as in the preceding experiments, and in the same irregular fashion.

In the experiments in which lanolin or a mixture of lanolin and petrolatum was applied in one eye and petrolatum in the other, it appeared, in all instances, that the inhibition produced by petrolatum in one eye, when lanolin was applied to the fellow eye, was greater than that produced when petrolatum alone was applied to one or to both eyes, but still was less than the inhibition produced by lanolin (tables 2, 3, and 4).

It seems possible that these animals may have been able to contaminate the petrolatum-treated eye with some lanolin.

TABLE 3

EPITHELIAL MOVEMENT IN VIVO. BOTH EYES TREATED WITH AN OINTMENT BASE

		Time after Injury (2 hr.)			
L.E. Lanolin	R.E. Petrolatum	L.E. Lanolin	R.E. Mixture of Lanolin & Petrolatum	L.E. Petrolatum	R.E. Mixture of Lanolin & Petrolatum
%	%	%	%	%	%
40 28	71 36	25 36	34 35	40 43	41 39
16 21	25 24	18 28	32 33	32 38	50 50
44 50	44 62				
17 12	52 64				
39 45	56 55				
25 22	43 40				

REMOVAL OF THE INHIBITING FACTOR FROM LANOLIN

Since we had found, in amplification of

the results of previous workers, that lanolin retards the healing of corneal epithelial injuries, and, since lanolin is a complex mixture of many components, it seemed desirable to attempt the removal of the toxic agent from lanolin. A simple procedure for fractionation suggested itself, consisting in shaking the lanolin vigorously with various aqueous solutions and subsequent separation by centrifugation. Preliminary experiments were made with distilled water, physiologic-saline solution, Tyrode's solution, and phosphate buffer as the washing fluid. It appeared that M/100 phosphate buffer (pH 7.4) plus 0.9-percent NaCl, conforming to the pH and osmotic pressure of the tear fluid[7] was the most effective.

In nine animals, the effect of treatment with washed lanolin was compared with an untreated control eye in the same animal (table 2). In three additional animals the effect of washed lanolin was compared with that of petrolatum album in the fellow eye (table 4). In 11 out of these 12 experiments, the washed lanolin showed no inhibitory effect whatever. In one out of the 12 experiments, some of the wounds showed retarded healing. It is plain that the inhibiting agent had been largely removed or destroyed.

TABLE 4

EPITHELIAL MOVEMENT IN VIVO. BOTH EYES TREATED WITH AN OINTMENT BASE.

		Time after Injury (3 hr.)							
L.E. Lanolin	R.E. Petrolatum	L.E. Lanolin	R.E. Mixture of Lanolin & Petrolatum	R.E. Petrolatum	R.E. Mixture of Lanolin & Petrolatum	L.E. Petrolatum	R.E. Petrolatum	L.E. Washed Lanolin	R.E. Petrolatum
%	%	%	%	%	%	%	%	%	%
42	43	42	53	40	50	82	85	85	88
72	65	60	64	53	55	92	90	88	89
60	66	80	82	70	52	96	100	94	73
69	80	75	100	58	50	93	98		
62	75			92	77	83	75	82	86
46	56			100	72	89	79		
82	75			72	70	88	93		
61	70			60	59				
50	73					82	86		
21	73					97	93		
78	70					82	84		
87	85					94	89		
58	77								
72	87								
75	84								
78	90								
73	88								

The effect of the washed lanolin was very markedly less than that of the U.S.P. lanolin, and probably significantly less than that of petrolatum. Every eye treated with U.S.P. lanolin and 10 out of 36 eyes treated with petrolatum showed some wounds with retarded healing.

It might be supposed that the diminished toxicity of the washed lanolin could be at-

tributed to the possibility that this material was less well retained in the conjunctival sac than U.S.P. lanolin. Careful observations, however, showed that the washed lanolin was just as well retained, and formed a film over the cornea just as effectively as did U.S.P. lanolin. The failure of the washed lanolin to exhibit an appreciable retarding influence on the healing of corneal wounds indicates that the inhibition produced by U.S.P. lanolin is attributable to some toxic component of this material, and is not due to the mere presence of foreign material in the healing wound.[3]

Summary and Conclusions

1. U.S.P. lanolin produces a pronounced inhibition in the healing of minute wounds of the rat's corneal epithelium.

2. U.S.P. petrolatum album produces a similar inhibition but to a much smaller extent.

3. Repeated washing of U.S.P. lanolin with an appropriate aqueous wash fluid removes or destroys the toxic component without apparently seriously affecting those physical characteristics of lanolin which make it so desirable a component of ophthalmic ointment bases.

Southern Life Building.
1212 Eutaw Place (17).

TABLE 5

Epithelial movement in vivo. One eye rubbed with glass rod, the second eye treated with an ointment base

	Time after Injury (3 hr.)				
L.E. Cornea Massaged	R.E. Lanolin	L.E. Cornea Massaged	R.E. Petrolatum	L.E. Cornea Massaged	R.E. Mixture of Lanolin & Petrolatum
%	%	%	%	%	%
100	75	100	91	93	88
93	67	100	100	100	95
93	73	95	75		
		97	86		

References

1. Smelser, G. K., and Ozanics, V.: Effect of chemotherapeutic agents on cell division and healing of corneal burns and abrasions in the rat. Am. J. Ophth., 27:1063 (Oct.) 1944.

2. Smelser, G. K.: The influence of vehicles and form of penicillin and sulfonamides on mitosis and healing of corneal burns. Am. J. Ophth., 27:541 (May) 1946.

3. Berens, C., de Gara, P. F., and Loutfallah, M.: Effect of sulfonamide ointment on healing of experimental wounds of rabbit cornea. Arch. Ophth., 30:631 (Nov.) 1943.

4. Leopold, I. H., and Steele, W. H.: Influence of local application of sulfonamide compounds and their vehicles on regeneration of corneal epithelium. Arch. Ophth., 33:463 (June) 1945.

5. Friedenwald, J. S., and Buschke, W.: The influence of some experimental variables on the epithelial movements in the healing of corneal wounds. J. Cell. & Comp. Physiol., 23:95, 1944.

6. ———: Mitotic and wound-healing activities of the corneal epithelium. Arch. Ophth., 32:410 (Nov.) 1944.

7. Krogh, A., Lund, C. G., and Pedersen-Bjergaard, K.: The osmotic concentration of human lacrymal fluid. Acta physiol. Scandinav., 10:88, 1945.

NOTES, CASES, INSTRUMENTS

VISUAL-FIELD TESTING

Suggestions on technique

Louise H. Darley,* B.A.
New York

Roenne said: "It is a peculiarity of perimetry that its outward technique is so simple as apparently to make no demand, but to be feasible for the least experienced assistant of a clinic, and yet of all ophthalmic examinations it is perhaps the one which in reality requires the most experience and detachment." (Traquair)

Visual-field examination requires not only technical knowledge but a certain skill in the way the tests are conducted. The examiner quickly realizes that the more careful the testing the better the results and the greater the ease with which they are obtained. The following suggestions on visual field testing are not intended as complete or specific instructions, but as a reminder of certain points to be emphasized and pitfalls to be avoided.

1. Make the patient comfortable and at ease.

2. Eliminate noise and other distracting influences as much as possible.

3. Adjust patient to instruments so that fixation point is at eye level and directly ahead of eye being tested. Measure distance from eye to fixation point accurately. Avoid any type of eye patch which exerts pressure on the eyeball. Always use fresh gauze or tissue under the patch. Allow time for patient to become adapted to a change in light (as from sunlight to the seven foot-candles commonly used), and accustomed to the temporary use of one eye alone.

4. Be sure that the patient understands his role in the test. This should include some comprehension of the underlying purposes of the test. Many tests fail or are incorrect because the patient does not know exactly what is required. Make clear that the answers refer to the test object itself, not to the moving hand, pin, or rod. Emphasis on this point on the peripheral-field test facilitates later outlining of the blindspots and the discovery of defects within the fields.

5. Base the size of the test objects to be used on the central visual acuity, except when the acuity is low but peripheral vision good. Make allowance for persons incapable of good attention, slow reaction, those unduly nervous, and so forth. More reliable if less refined results may be obtained in these instances by using a test object larger than standard for the acuity. The scale of suggested test object sizes is given in Table 1. Consider the use of white objects of more than one size and the use of colors. Attempt to get the field for full saturation and investigate the intensity of colors, including pastel green, in significant areas. Increase or decrease the distance, or reduce the amount of illumination, if the circumstance warrants or to rule out or confirm a suspected defect.

6. Examiner's hands, rod-holding object, and so forth, should be held in the background or in as unobtrusive a manner as possible. Rod should be of a material that blends into the background, and test objects should be kept clean and bright.

7. Be careful of speed, manner, and direction of movement of test object. Work as swiftly as possible without reducing accuracy. Establish a methodical routine, as peripheral before central field test, right eye first unless vision is much poorer than left, peripheral coverage clockwise or counterclockwise. Contractions, errors, or the uncommon but confusing spiral field will be more obvious if consecutive meridians are tested. Work consistently from seeing to nonseeing, or from nonseeing to seeing areas, preferably the latter. The greatest accuracy will be obtained by combining these two

* Perimetrist, Manhattan Eye, Ear, and Throat Hospital.

methods. If disc-type test objects are used, be sure the object is not tipped but flat against the background arc.

8. Watch the patient's position, fixation, and attention throughout the tests, and maintain alertness by constant questioning. Good coöperation should be commended. Allow rest between peripheral- and central-field tests and frequent short rests during both. Check the patient's coöperation by removing or turning objects from sight or by questioning in known seeing and nonseeing areas.

9. Test enough meridians for thorough coverage (at least 12 on the perimeter and probably more on the tangent screen). It may be of practical use to carry the test object on in toward fixation along several meridians of the perimeter (after the peripheral isopters have been determined) in order to locate gross defects or others, such as an annular scotoma, which may lie outside the area covered by the tangent screen. In theory, every square millimeter of the field included by the tangent screen or campimeter is explored for defects. In practice, this cannot be done, but care should be taken to cover it as thoroughly as possible. Map out pattern roughly then fill in details. Move test object at right angles to the borders of the blindspot and of any discovered defects. If patient (and examiner) become confused, leave the difficult area and return to it after a rest or completion of another section of the field. Keep the developing pattern in mind and concentrate on significant areas.

10. If no diagnosis has been made, fields must be examined carefully for any and all defects. If case has been diagnosed, or tentatively so, or if any clues are found in eye or general history or in patient's conversation, pay particular attention to suspected segments (such as nasal portions, blindspots,

TABLE 1

TEST OBJECT SIZES FOR PERIPHERAL AND CENTRAL VISUAL FIELD TESTS*

Central visual acuity		Test object size—*millimeters*	
Feet (approximate equivalents)	Meters	Perimeter	Tangent screen (at 1,000 mm.)
Blind			
Light perception		Flashlight, diffuse (gross)	
Light projection		Pencil of light, focal (fine)	
Hand movements		Use smallest object perceived, as hands, fingers or large test objects	
Count fingers			
20/400	6/80	Same	
20/200	6/60	5, 10, 15 and larger	
20/100	6/50		3, 5, up to 10, 17, 35
20/ 70	6/40		Double the size for colors
20/ 50	6/20		
20/ 40	6/10		2 to 5
20/ 30	6/7.5	3	
20/ 20	6/ 6		1, 1½, 2, 3
20/ 10	6/ 4		Triple the size for colors

* Test object sizes are approximate, depending on quality of vision, whether or not patient has had test before, ability to coöperate, and so forth.

and related areas in glaucoma, central in retrobulbar neuritis, hemianopic tendencies in chiasmal or brain lesions, and so forth). If no defect is found, indicate as much as is needed to show that a careful search was made.

11. Peripheral field tests should be made without glasses if possible. Elevate eyelids if they appear to reduce the superior field. Tangent-screen tests should be made with best vision, that is, with distance correction if the patient is accustomed to wearing glasses. Watch that rims do not interfere, especially in temporal field. Try to adjust patient with very strong correction so that peripheries are least distorted; the plane surface of the corrective lens should be placed at right angles to the test object stimulus rather than the fixation point. Turn head slightly but do not tilt. If bifocal lenses are worn, raise screen or readjust glasses to avoid blurring in lower field.

12. If both tangent screen and perimeter examinations are impossible, try a confrontation test or examine for light projection. Not infrequently, useful information is missed by ignoring an eye that, as judged by acuity, appears to have too little vision for ordinary field testing.

13. Fixation of those patients with either relative or absolute central defects may be aided by such means as enlarging the fixation point or using light tape or lines crossing at the fixation point and extending beyond the borders of the scotoma. This can be done on perimeter and tangent screen. Instruments such as the stereocampimeter are usually equipped with a mechanical fixation device for such cases. Watch for eccentric fixation with an old central defect and try to induce proper position of the eye.

14. Try not to "read in" a pattern from confusing answers and be cautious about suggesting to the patient that he sees or does not see in different areas. Be on guard for malingering and, if suspected, try comparison fields for different size test objects, increased distance, and so forth. Use the same methods to identify the so-called hysteria field.

15. Record all information regarding the test: (a) Patient's name; (b) clinic or other number, if any; (c) date; (d) visual acuity, O.U., with and/or without correction; (e) instrument used; (f) amount of illumination; (g) size (state whether millimeters or degrees) and color of test objects; (h) distance at which test was done; (i) done with or without correction; (j) remarks as to patient's coöperation, reliability as well as other impressions or qualifications; (k) signature of examiner; (l) indicate each scotomatous area and the various isopters clearly.

16. Orderliness in testing procedures should be associated with similar attention to the care of the apparatus. Leave the field room and all equipment in good condition and ready for later use by yourself or by others.

17. In a subjective test of this sort the examiner is forced to obtain and rely on the coöperation of the patient. Time taken to gain his confidence and interest is not a luxury but promotes accuracy. There are some instances when all efforts fail and the patient either cannot or will not coöperate to the extent that a reliable test can be made. Another attempt at a later date may yield more satisfactory results.

210 East 64th Street (21).

I wish to thank, among others, Mrs. Virginia S. Boyce, National Society for the Prevention of Blindness, Dr. F. Philip Koch of the Glaucoma Clinic, and members of the staff of the Manhattan Eye, Ear, and Throat Hospital, for their helpful advice and encouragement to present these suggestions on visual-field technique.

References

Agatston, H.: Ocular malingering. Arch. Ophth., **31**:223-231 (Mar.) 1944.
Birge, H. L.: Ocular war neuroses. Arch. Ophth., **33**:440-448 (June) 1945.
Chamlin, M.: Technical methods for the 1/2000 field. Am. J. Ophth., **30**:1415-1423 (Nov.) 1947.

Evans, J. N.: An Introduction to Clinical Scotometry. New Haven, Yale University Press, 1938.
Hardy, L. H.: Scotometry: History and technique; with a scotometric tangent screen and scales. Tr. Am. Ophth. Soc., 29:486-686, 1931.
Rucker, C. W.: The interpretation of visual fields: A manual prepared for the use of graduates in medicine. Section on Instruction, Home Study Course. Am. Acad. Ophth., 1946.
Traquair, H. M.: An Introduction to Clinical Perimetry. St. Louis, Mosby, 1944, Ed. 4.

CLINICAL OBSERVATIONS OF THE EFFECT OF TOBACCO ON THE ANGIOSCOTOMA IN GLAUCOMA

MARION MACDONALD CASTAGNO, M.D.
Hartford, Connecticut

Should the patient with glaucoma be allowed to smoke? The purpose of this paper is to answer this question by reporting changes which were noted in the angioscotoma after smoking one cigarette by patients with the confirmed diagnosis of glaucoma simplex.

METHODS AND MATERIALS

Angioscotometry is the study of visual field defects "radiating from the blindspot of Mariotte and related in form to the pattern of distribution of the retinal vessel tree."[1] These field defects are apparently related to changes in the retinal perivascular spaces and synaptic junctions.

The scotoma was mapped according to the technique advocated by Evans.[2] The Evans direct plotting charts in the campimeter were used with monocular fixation. The diameters of the test objects were from 0.4 mm. to 5.0 mm. Illumination on the chart was 15 foot-candles. The object was moved from the seeing to the blind region. The blindspot was first outlined and then the angioscotoma was mapped.

The subjects of this study were private patients suffering from chronic glaucoma simplex. Each patient smoked cigarettes habitually. On the day of the examination they had refrained from smoking at my request. Each was familiar with the technique of angioscotometry so that fear of a new procedure did not enter into the picture.

CASE REPORTS

Case 1 (fig. 1). M. R., was a 68-year-old woman with chronic simple glaucoma well controlled by miotics. Ocular tension was 25 mm. Hg (McLean) in each eye. She smoked 20 cigarettes daily. A preliminary angioscotoma was mapped. She then smoked a cigarette of her favorite brand to the customary length (4.5 cm. smoked).

An angioscotoma was mapped immediately after smoking. Within five minutes of smoking, the patient could see neither the fixation point nor a 5.0-mm. object with the left eye. In the right eye, the increase in the size of the angioscotoma was more gradual, taking 15 minutes to reach the maximum increase in scotoma units over the original. It took a total of 45 minutes for the angioscotoma to return to normal. At the completion of the tests, tension was: O.D., 25 mm. Hg; O.S., 35 mm. Hg (McLean).

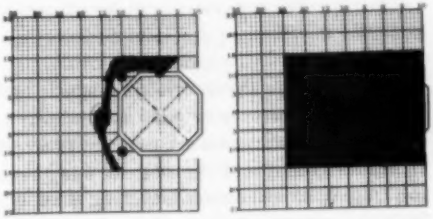


Fig. 1 (Castagno). *Case 1.* Preliminary angioscotoma (left) before smoking. Incidentally, this demonstrates macula-wedge sign of Evans. (Right) The angioscotoma within five minutes after smoking, showing inability to see fixation or 5.0-mm. object.

Case 2 (fig. 2). F. P., a 38-year-old woman, had suffered from glaucoma in each eye for four years. Ocular tension was: O.D., 80 mm. Hg; O.S., 86 mm. Hg (McLean) uncontrolled by miotics. An angio-

scotoma of the right eye was mapped using a 0.4-mm. object. The patient then smoked 4.5 cm. of her usual brand of cigarette.

On remapping the angioscotoma after smoking, there was immediately an inability to see the 0.4-mm. object which had been used to map the original angioscotoma. A 0.6-mm. object was used and a tremendous increase in the size of the scotoma was noted, the angioscotoma almost reaching fixation. The angioscotoma returned to the original size 60 minutes after smoking. The ocular tension did not change.

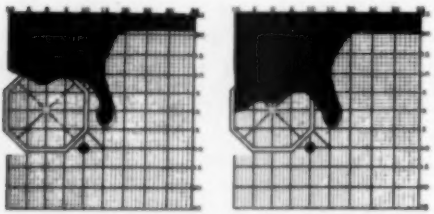


Fig. 2 (Castagno). *Case 2.* Preliminary angioscotoma (left) before smoking. (Right) The angioscotoma after smoking, demonstrating an increase in the size of the scotoma which almost reaches fixation. A larger object was used to map the second angioscotoma because of the patient's inability to see the object which had been used for the preliminary angioscotoma.

Case 3 (fig. 3). D. D., a 62-year-old man, had had a known chronic, simple glaucoma in the right eye for eight months. The ocular tension was 34 mm. Hg (McLean) in each eye with three-percent pilocarpine being used three times daily in the right eye. The patient smoked 40 to 50 cigarettes daily. An angioscotoma of the right eye was mapped using a 0.6-mm. object. The patient then smoked 4.5 cm. of his customary brand of cigarette.

An angioscotoma was then remapped. Within 20 minutes, the scotoma increased in size, showing successively a macular-wedge sign of Evans,[3] Seidel sign, a Bjerrum's scotoma, and the Roenne step. Forty-five minutes later the scotoma had returned to the original size and shape. The ocular tension after the testing was: O.D., 36 mm. Hg; O.S., 34 mm. Hg (McLean).

Discussion

It has been shown that both the general effects[4] and the effects on the angioscotoma of the normal eye[5] of smoking a cigarette are apparently due to the nicotine content of the cigarette. Nicotine produces a generalized peripheral vasoconstriction.[6] The action of nicotine is first a transient stimulation and then a secondary depression of all sympathetic and parasympathetic ganglia due to direct action of the ganglia.

Evans states that he believes, "Contraction of the fibers of the astrocytes, which send footplates to form the wall of the perivascular space, also increases the amount of fluid within the space by virtue of the greater cross-section thus created. Should the blood vessel contract, this again would result in an increased area of the space. On the contrary, should the vessel dilate, fluid in the space would be forced either back into the retinal spaces or out the posterior channels of escape. Since the escape of fluid is relatively slow as compared to the rapid dilatation of the vessel, there would be at least a temporary damming up of the fluid with a consequent edema of the synapse. This interruption of function would result in loss of response of the rods or cones of the corresponding chains."[2]

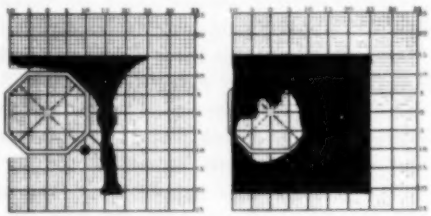


Fig. 3 (Castagno). *Case 3.* Preliminary angioscotoma (left) before smoking. (Right) The angioscotoma after smoking, demonstrating an increase in size of the scotoma and a macula-wedge, Seidel sign, a Bjerrum's scotoma, and the Roenne step.

The deleterious effect of nicotine on the synapse is the fuse that probably starts the protective mechanism described by Evans.

In the cases herein reported, smoking of one cigarette caused a change in the angioscotoma similar in type to that change which Fink[6] found in patients without glaucoma, but out of proportion in degree.

In the first case, the enlargement of the angioscotoma was so pronounced that the fixation object could not be seen with the left eye. In the second case a larger test object had to be used because the original object was no longer visible. In the third case an amazing progression of the size and shape of the angioscotoma occurred from the primary macular-wedge sign of Evans through the demonstration of Roenne's nasal step. This latter angioscotoma would lend support to the thesis of both Evans and Magitot[7] that the field changes in glaucoma are primarily vascular.

Duke-Elder[8] states that "the most fundamental change is a vascular instability or inefficiency which, when it involves an acute stasis, may determine the onset of a congestive glaucoma and, when less dramatic changes occur, may determine the evolution of a simple glaucoma. Such a vascular crisis or prolonged inefficiency may be compensated in a healthy eye; but if the circulation of the aqueous is already impaired by sclerotic or other pathologic changes, a rise of tension will become evident more easily: a contributory factor of the greatest importance therefore is any embarrassment to the circulation of the intra-ocular fluid."

Conclusions

In the three cases cited here, the smoking of one cigarette caused marked changes in the angioscotoma. These changes were unaccompanied by subjective symptoms in any one patient. Repeated smoking of cigarettes by these patients would seem to be an almost chronic insult to the vascular stability in their eyes.

It is not suggested that smoking is the direct cause of glaucoma in these patients. Whether the habitual use of tobacco in hyper-reactive glaucoma patients hastens the progression of their disease as it is thought to do in Buerger's disease and tobacco amblyopia is unknown. Each patient with glaucoma who smokes should have determined whether he is hyper-reactive to nicotine.

The technique of angioscotometry, using small test objects is an available and practical direct method of determining the effect of smoking. If our aim is to diminish the vascular instability in glaucoma as part of the treatment of the patient as a whole, it would seem advisable that patients who have glaucoma and are hyper-reactive to nicotine should refrain entirely from smoking.

215 Washington Street.

References

1. Evans, J. N.: A preliminary report of the retinal vessel scotoma. Am. J. Ophth., **9**:118-119 (Feb.) 1926.
2. ———: Clinical Scotometry. New Haven, Conn., Yale University Press, 1937.
3. ———: The macula-wedge scotoma: A prognostic index in glaucoma. Am. J. Ophth., **27**:1090-1093, 1944.
4. Roth, G. M., McDonald, J. B., Sheard, C.: The effect of smoking cigarettes and the intravenous administration of nicotine on the heart and peripheral blood vessels. Med. Clinics North America, **29**:949-957 (July) 1945.
5. Goodman, L., and Gilman, A.: The Pharmacological Basis of Therapeutics. New York, Macmillan, 1941.
6. Fink, A. I.: Clinical study of effect of tobacco on the normal angioscotoma. Arch. Ophth., **35**: 15-19 (Jan.) 1946.
7. Magitot, A.: Ann. d'ocul., **43**:321-341, 1947.
8. Duke-Elder, W. S.: Textbook of Ophthalmology. St. Louis, Mosby, 1938. v. 3. p. 3355.

ADENOCARCINOMA OF THE MEIBOMIAN GLAND*

MARION L. RICE, M.D., AND HAROLD I. LINDEKE, M.D.
Memphis, Tennessee

Malignant tumors of the meibomain gland occur more frequently than the literature would lead one to believe. Due to their gross resemblance to chalazia, these tumors are of great clinical importance because of the morbidity and mortality that can follow inadequate excision.

Tumors of this gland are classified as: (1) Glandular hyperplasia, (2) adenoma, and (3) adenocarcinoma (epithelioma). The first adenoma was reported by Baldauf[1, 2] in 1870, and carcinoma was first described by Allaire[3] in 1891. The nomenclature is confusing in the early literature. Several authors considered all tumors of the meibomian glands malignant, while others could not differentiate between the types. The adenoma, in the patient reported by Knapp,[4] more closely resembles an adenocarcinoma. Lebensohn[5] found that adenomas and carcinomas occurred with equal frequency. Hagedoorn reviewed this problem in 1934 and found that 50 percent of the benign tumors became malignant. The present opinion is expressed by Warren,[6] who considers the majority of the "adenomas" are, in fact, hyperplastic glands, and that true adenomas are rare.

Since there is no pathologic survey of all chalazia excised, the true incidence of malignancy is not known. According to Warren,[6] carcinomas occur more frequently in the meibomian gland than in any other palpebral or sebaceous gland. Lazarescu[7] reviewed the cases of the ophthalmic clinic in Issay, Roumania, for the period 1916 to 1929, and gave the only comparative study in the literature. Of 22,288 consultations there were 58 cases (0.26 percent) of carcinoma occurring in the region of the eye, and 25 (43.28 percent) of these were of the lid. Only one carcinoma of the meibomian gland was reported and this was diagnosed an epithelioma.

Martin,[8] of Memorial Hospital, New York, reports 149 cases of carcinoma, occurring in the region of the eyelid, for the years 1925 to 1935, and does not mention meibomian-gland carcinoma. Sie-Boen-Lian[9] reported carcinoma of the meibomian gland in nine patients who were seen in his clinic during the five-year period, 1934 to 1939. Hagedoorn[10] and Lebensohn,[5] in excellent reviews of the literature, reported 70 cases for the years 1871 to 1937. Since these reports, 26 cases have been added to the literature. The case presented in this paper brings the total of reported instances of carcinoma of the meibomian gland to 97, of which only 12 are in the American literature.

CHARACTERISTICS

This malignant growth has an insidious evolution, usually taking one year to reach a noticeable size. It occurs both in males and females, usually after the age of 40 years, but has been reported in a patient three and one-half years of age.[1] It is often mistaken for a chalazion from which it cannot be differentiated clinically. It occurs with equal frequence beneath the skin and conjunctival surfaces, most often in the upper eyelid. The neoplasm has a firm and cartilaginous consistency. It is nodular and appears yellow through the stretched skin or conjunctiva.[1, 11] If the tumor presents on the conjunctival surface, it is surrounded by minute gray nodules. Late in the development it may involve the entire lid, including the margin, ulcerate the conjunctiva and cause chemosis.

When inadequate surgery is performed,

* From the Laboratory Service and Ophthalmology Section, Veterans Administration Medical Teaching Group, Kennedy Hospital, Memphis, Tennessee. Sponsored by the Veterans Administration and published with the approval of the chief medical director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

the evolution achieves malignant tendencies ranging from frequent recurrence[4, 5, 7, 12] to rapid orbital involvement,[9, 13, 14] lymph-node and parotid-gland involvement,[3] and death.[13] Radnot[11] and Lebensohn[8] mention Riva's series of 16 cases with five fatalities. Lazarescu[7] quotes Komoto and Shoji as stressing the frequent orbital metastases which occur due to the abundant lymphatic drainage. The cases reported by Snell[14] and Wootton[13] also emphasize this feature. Snell reported a case of a 63-year-old woman with a small tumor in the upper lid of six years' duration. It was removed only to reoccur in one year. This necessitated excision of a portion of the lid. The following year it was necessary to excise the globe and exenterate the orbit. One year following this operation, the orbit was filled with the neoplastic growth and the cervical nodes were involved.

The suggested treatment consists of wide excision of the growth followed by irradiation[8] in advanced cases. Lid resection and plastic repair may be necessary due to the size of the tumor mass.

Case report

History. C. M., a 26-year-old white man, developed pain in the left eye in 1944, while in the U. S. Army. He was told that he had a "conjunctivitis and a blister that had ruptured on the inside of the upper lid." From 1944 to 1946 he had several recurrences of this pain, but did not see a physician. When admitted to this hospital, in March, 1949, he complained of a purulent discharge, in the region of the inner canthus, of two years' duration.

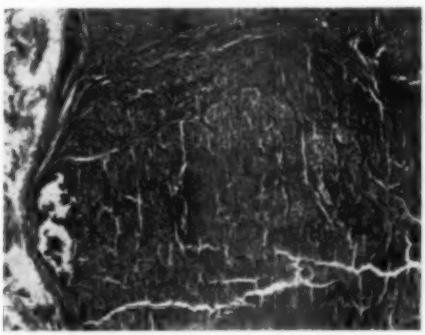


Fig. 1 (Rice and Lindeke). Tumor mass, showing an adenomatous arrangement with fibrous septa. Chronic inflammatory-cell infiltration and a foreign-body giant cell are seen in the periphery.

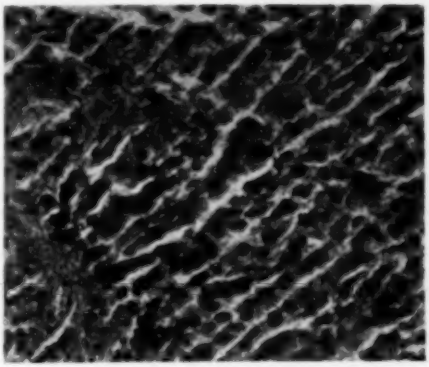


Fig. 2 (Rice and Lindeke). Cellular detail. Note the large cells with a foamy or granular cytoplasm. A cell with a mitotic nucleus is near the right upper corner. In the lower left portion, there are anaplastic cells.

General physical examination was normal.

Eye examination. The right eye was normal. The skin in the region of the canthi of the left eye was irritated. There was moderate injection of the palpebral conjunctiva and mucus in the cul-de-sac. Protruding from the conjunctiva, in the central portion of the tarsus of the upper eyelid, there was a flattened, peduncular, granular mass, measuring 0.5 cm. in width at the base and 1.0 cm. in length. It did not bleed. This was considered a simple granuloma. The mass, including a large pus pocket at the base, was excised.

Microscopic description. The tumor was a glandular carcinoma (fig. 1). Normal meibomian gland acini were present at the base. The malignant sebaceous acini were 10 times the normal size, and were separated by fibrous tissue septa. Only an occasional lobule had a peripheral zone of basal cells. The conjunctiva was compressed and ulcerated distally. The acini were solid and

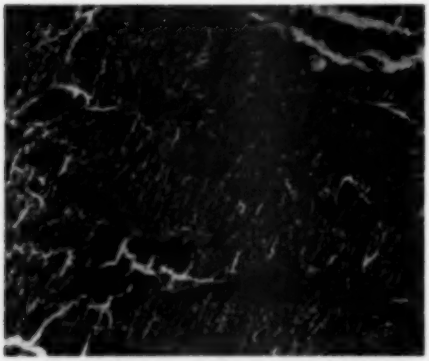


Fig. 3 (Rice and Lindeke). Sebaceous tumor acini showing cornification.

composed of two types of sebaceous tumor cells (fig. 2)—one large, having foamy or vacuolated cytoplasm with a large vesicular nucleus that contained a prominent nucleolus; the second was small, irregular, having a dark-staining cytoplasm with an irregular hyperchromatic nucleus. Some acini contained areas of cornification (fig. 3). Mitosis was present throughout the neoplasm. Sudan-IV stain (fig. 4) showed that the vacuolated appearance of the cytoplasm was due to deposits of irregular fat particles. The fat within the normal acini was homogenous. This tumor was diagnosed as a sebaceous adenocarcinoma, using the criteria of Hagedoorn.

Operation. Following this diagnosis, a wide excision of the surrounding area was performed, followed by electric coagulation. Microscopic examination of the tissue from the immediate area of previous excision revealed a lobule of malignant cells similar to those in the original mass. The peripheral zones of the excised tissue were free of involvement.

Ninety days after discharge, the patient returned for a follow-up examination. He complained only of swelling and redness of the left upper and lower eyelids which had been present for two days. The upper lid was edematous, and the palpebral conjunctiva of the upper and lower eyelids was injected. No mass was present in the eyelid, and no pre-auricular adenopathy was present.

A diagnosis of acute conjunctivitis was made and treatment was instituted. There was a small, triangular, flat, smooth piece of tissue loosely attached to the center of the palpebral conjunctiva at the site of original mass. This was excised and diagnosed microscopically as chronically infected granulation tissue.

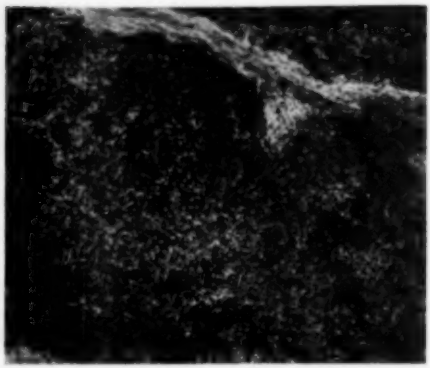


Fig. 4 (Rice and Lindeke). Sudan-IV stain, showing irregular fat particles within the cytoplasm.

Conclusion

This case demonstrates the ease with which malignant growths of the eyelid can be clinically mistaken for granulomatous tissue. It would be ideal, but impractical in many instances, to examine all chronic chalazia for possible malignancy. However, it is imperative that all growths clinically resembling recurrent chalazia that follow surgical excision or rupture, should be examined histologically.

Kennedy Veterans Hospital.

References

1. Hagedoorn, A.: Adenocarcinoma of a meibomian gland. Arch. Ophth., 12:850-866 (Dec.) 1934.
2. Salzmann, M.: A contribution to the study of tumors of the eyelids. Arch. Ophth., 20:380-391, 1891.

3. Beach, A., and Severance, A. O.: Sebaceous gland carcinoma. Ann. Surg., 115:258-266, 1942.
4. Knapp, H.: A case of adenoma of the meibomian glands with a synopsis of what is known on that kind of tumor. Tr. Am. Ophth. Soc., 1901, p. 328.
5. Lebensohn, J. E.: Primary carcinoma of the meibomian gland. Am. J. Ophth., 18:552-554 (June) 1935.
6. Warren, S., and Warvi, W. W.: Tumors of sebaceous glands. Am. J. Path., 19:441-459 (May) 1943.
7. Lazarescu, D., Lazarescu, E., and Ionescu, E.: A case of epithelioma of the meibomian glands. Brit. J. Ophth., 14:588-594 (Nov.) 1930.
8. Martin, H. F.: Cancer of the eyelid. Arch. Ophth., 22:1-30 (July) 1939.
9. Sie-Boen-Lian: Karsinom der meibomschen drusen in Batavia. Ophthalmologica, 101:205-214 (April) 1941.
10. Hagedoorn, A.: Adenocarcinoma of a meibomian gland: Report of additional cases. Arch. Ophth., 18:50-58 (July) 1937.
11. Radnot, M.: Ueber das Karzinom der meibomschen Drusen. Ophthalmologica, 96:22-28 (Oct.) 1938.
12. Hughes, A. C.: Multiple chalazia showing malignancy, Tr. Ophth. Soc. U. Kingdom, 52:557-558, 1932.
13. Wootton, H. W.: A case of adenocarcinoma of the upper eyelid subsequently extending to the orbit. Arch. Ophth., 56:275 (May) 1927.
14. Snell, S.: Carcinoma of the orbit originating in a meibomian gland. Ophth. Rev., 27:94, 1908.
15. Mills, J. M.: Adenocarcinoma of the eyelid. Arch. Ophth., 56:275 (May) 1927.

THE USE OF MILK-PROCAINE IN FOREIGN-PROTEIN THERAPY*

JOHN A. CETNER, M.D.
Albany, New York

Nonspecific foreign-protein therapy is still widely employed in spite of the increasing use of the various antibiotics. This is perhaps more true in the field of ocular therapeutics than in other specialties. It is generally agreed among ophthalmologists that foreign-protein therapy is a valuable weapon to combat inflammatory diseases of the eye. The two agents most commonly utilized for this purpose are killed typhoid bacilli and skimmed milk.

Since intravenous typhoid may be attended by serious complications, its use is ordinarily reserved for cases that are hospitalized where trained personnel can meet any emergency that may develop. However, it is not always possible nor desirable to confine a patient in a hospital, and in such instances boiled milk is used intramuscularly as an office procedure.

The chief disadvantage with the use of milk is the severe local pain and soreness that develop at the site of the injection and persist for as long as 2 to 4 days. Frequently the patient complains more bitterly about the treatment than the eye disease for which the treatment was given.

This undesirable feature can, to a large extent, be obviated by combining procaine with the milk. The recent widespread practice among the commercial drug houses of compounding penicillin and procaine suggested this. So far as I have been able to determine, the milk-procaine idea has not previously been reported in the American literature.

Milk-procaine was given a trial in several patients. The results were gratifying, and very little local discomfort was reported. The procedure is simplicity itself.

Skimmed milk is boiled for three minutes and cooled. A sterile 10-cc. syringe containing two cc. of four-percent sterile procaine hydrochloride is used to aspirate nine cc. of milk. The total of 11 cc. of the milk-procaine combination is then given intramuscularly in the gluteal region. The milk and the procaine are compatible and completely miscible.

365 State Street.

*From the Department of Ophthalmology, Albany Medical College.

VISUAL DISTURBANCES DUE TO THE USE OF DIGITALIS AND SIMILAR PREPARATIONS

JOSEPH V. M. ROSS, M.D.
Berwick, Pennsylvania

Much has appeared in ophthalmic literature about visual disturbances due to digitalis and similar preparations. Gillette's* article is an excellent review of visual symptoms of digitalis intoxication and his bibliography is extensive. Gillette makes no reference to digitoxin but other papers concerning this drug have appeared since 1946.

From all the writings, the fact emerges that visual disturbances following digitalis and digitalislike preparations are not uncommon. The expressions, however, are variable and the exact mechanism or mechanisms of action are unknown, even though the symptoms were recognized and reported by Withering himself.

One of the problems discussed is the presence or absence of diplopia as part of the visual symptom complex. Herewith are reported three cases all of which were characterized by diplopia and all of which were believed due to digitalis or digitoxin intoxication.

CASE REPORTS

CASE 1

This patient was a white woman, aged 58 years. Her only visual complaint was diplopia. Her vision was 20/30, O.U., correctible to normal for near and far. All ophthalmic studies revealed normal findings except for her extraocular muscle status.

This patient had had her right kidney removed in 1943 but her remaining one was functioning properly. There was no hypertension but she had an annoying heart irregularity for which digitoxin had been given. She had taken 5.0 mg. of this drug before the sudden onset of diplopia. There were 6Δ of right hyperphoria in straight gaze. Further muscle and prism studies revealed a paresis of the right superior oblique muscle.

Upon withdrawal of the digitoxin, all findings were normal after two weeks. When digitoxin was given again, the paresis reappeared. It again disappeared in two weeks after cessation of the drug.

CASE 2

This patient, a white woman, aged 73 years, had had high blood pressure for years. When first seen, corrected vision was: 20/40, O.U., for near and far. She presented a bilateral hypertensive retinopathy, Grade 3, with hemorrhages, both superficial and deep, and retinal transudates.

A few months later, after having ingested 84 gr. of digitalis, the patient complained of a right ptosis and diplopia—the former due to levator paresis; the latter, to a paresis of her right superior rectus muscle. Blood pressure was approximately 160/100 mm. Hg throughout her course. She also complained of all the usual symptoms of digitalis intoxication as anorexia, nausea, vomiting, slight diarrhea, fatigue, alterations in cardiac rhythm and rate, and chromatopsia (which she described as blue smoke rings before her eyes surrounding objects that looked whiter than usual).

Vision was reduced to 20/70, O.U., for near and far. Central field studies at one meter with a one-mm. white test object revealed bilateral small pericentral scotomas. However, from these studies it is not clear if such field findings indicated a prechiasmal syndrome or retinal disease undetectable ophthalmoscopically.

Digitalis was stopped and vitamin B-complex with vitamin C was given parenterally every other day. There was a recovery of vision to 20/40, O.U., for near and far, in three weeks, and normal fields and muscle action in seven weeks. The possibility of a vascular basis for the paresis of the superior branch of the third cranial nerve must be considered.

* Tr. Am. Ophth. Soc., **44**: 156-165, 1946.

CASE 3

This patient, a white man, aged 65 years, had these complaints: (1) Staggering when he walks, (2) headaches, worse on the left side, (3) diplopia.

He stated that eight weeks ago he experienced weakness, dyspnea, and swelling of his legs. His blood pressure was, is, and always has been, normal. For the past two weeks he has been taking digitoxin and his total intake had been 7.4 mg. His symptoms had appeared rather suddenly several days ago.

He presented normal vision with lenses for far and near, but showed 10Δ of right hyperphoria, straight ahead. Further muscle and prism investigations revealed a paresis of the right superior oblique. With withdrawal of digitoxin and giving of one cc. of benadryl intravenously and one cc. of depropanex intramuscularly every other day, recovery was rapid in one week. However, 4Δ of right hyperphoria remains to this day and prisms are worn with comfort.

DISCUSSION

Only the salient features of these case reports are mentioned; however, many studies were done. In only one case was specificity of the drug's action tested, and here with return of drug intake, symptoms recurred. Admittedly, the unilaterality in these cases is hard to explain (although one case did show bilateral scotomas). Attempts to eliminate other causative factors, however, seemed to substantiate the belief that drug intoxication was involved. The response to benadryl, an antihistaminic, and depropanex, a vasodilator, in one case was dramatic. In an unreported case exhibiting a prechiasmal syndrome with bilateral cecocentral scotomas following digitoxin administration, the response to benadryl and depropanex was equally dramatic, although the drug was not withdrawn.

This suggests that the toxicity may be related to vasospasm and/or allergic phenomena of increased capillary permeability and excessive irritability of smooth musculature. It would seem that digitoxin might have a special affinity for the papillomacular bundle but also that it (and other digitalis preparations) must have neurotoxic properties not so localized which may be related to acetylcholine inactivation.

321 East Front Street.

CORRUGATED SILVER WIRE FOR SEVERING PTERYGIUM FROM THE CORNEA

PAUL TOWER, M.D.
Los Angeles, California

Various surgical procedures have been proposed for the treatment of pterygium and, depending on the technique mainly employed for correction of that condition, the operative methods may be arranged into five groups: (1) Ablation, that is, removal of the thickened membrane through excision or curettement; (2) ligation; (3) electrosurgery, that is, electrocoagulation, fulguration, desiccation, or diathermy; (4) separation of the head of the pterygium from the cornea, followed by rotation and implantation beneath the bulbar conjunctiva, in a direction deviating from its original line of growth; (5) insertion of a skin or mucosal graft beneath the conjunctiva.

While it is not intended to enter into a comparative evaluation of the various procedures for the management of pterygium, there remains little doubt, even after an incomplete survey of the literature, that the transplantation method, as originally described by McReynold,[1] is favored by the majority of authors. In my experience, the McReynold operation has proved satisfactory in almost 100 percent of all cases.

REMOVAL OF APEX OF GROWTH

The most essential part of any surgical procedure for the management of pterygium is the removal of the apex of the growth

from the cornea. Eradication of the head of the pterygium should be carried out in such a manner as to leave the epithelial surface of the cornea perfectly smooth, and its substance transparent.[3] Ziegler, as cited by Spaeth,[8] agrees with this opinion and maintains that success in the operative treatment of pterygium depends on thorough removal of its head, resulting in clear corneal tissue. But the outcome of the operation may still prove disappointing, even if only small residues of the episcleral growth remain at the limbus of the cornea,[4] as recurrences are particularly frequent in such cases.[5]

From the foregoing it may have become apparent that there exists no controversy as to the importance of complete removal of the head of the pterygium from the cornea. Nevertheless, recurrences do occur, and that with about equal frequency following use of any one of the different surgical methods. The suspicion was therefore bound to arise that a detail of operative technique common to all procedures may be responsible, or may at least greatly contribute to the incidence of recurrences.

Techniques described in literature

Ordinarily, scalpel, keratome, or scissors are used for dissecting the head of the pterygium, the choice of instrument depending mainly on the size of the growth as well as on the extent to which the cornea has become involved. If pterygial tissue remains upon the surface of the cornea, such residue is usually removed by means of curettage, or, more rarely, by cautery.

Spaeth[6] passes a sharp probe under the head of the pterygium and threads a "stout" silk suture through this perforation; the suture, in combination with iris forceps, is then used to tear the head of the lesion from the cornea; if necessary, the entire area in which the growth had been attached to the cornea is carefully curetted with a sharp spoon.

Wiener[7] stresses the need for radical excision and, in the presence of a large growth, recommends removal of the involved segment of the cornea together with the head of the pterygium. The cornea is incised to a depth of from 0.125 mm. to 0.25 mm. along the two lateral borders of the growth, but 0.5 mm. distant from the edges of the lesion; these incisions are carried forth to a meeting at a point 1.0 mm. beyond the tip of the pterygium. The apex of the triangle is grasped with a dural hook and the flap consisting of corneal, as well as pterygial tissue, is dissected with knife and scissors.

Radzichovskii[9] inserts two squint hooks under the neck of the pterygium; separation of the head of the growth from the cornea is brought about by pulling the hooks in opposite directions.

Doherty[9] grasps the upper and lower borders of the growth at a point slightly lateral to the limbus of the cornea, and introduces a suture. Reciprocating movements of the suture are used for severing the head of the growth from the cornea; if any pterygial tissue remains, it is removed by means of curettage.

For resection of the pterygium from the cornea, Gurley[10] uses a small muscle hook. The instrument is passed from above downward through the conjunctiva at a point slightly lateral to the limbus, and by a combination of teasing and rocking motions it is slowly carried to the head of the growth, thus separating its attachments to the cornea.

Experimentation with the different techniques described failed to lead to uniformly good results. In a number of cases, complete removal of pterygial tissue could not be effected. Incision of the cornea along the borders of the growth, which constitutes an essential part of some techniques, cannot in all instances be recommended. In certain other methods, the surgical approach would seem to be unnecessarily complicated, and what should amount to merely a minor intervention becomes a major operation.

Among all these procedures the use of a silk suture has proved to be safest and most satisfactory. Yet, in larger lesions the silk

suture will sometimes cut through the pterygium, or merely tear the head off, leaving part of the growth attached to the cornea. All these shortcomings, however, can be avoided if a metal wire is substituted for the silk suture.

Use of silver wire

In further trials it was established that best results could be obtained by using a No. 29-gauge silver wire with very fine corrugations. Wires drawn from other metals, including tantalum, proved to be lacking either in flexibility or in strength, and had to be discarded. Ordinary silver wire of No. 29-gauge, on the other hand, as it is sold by surgical supply houses, is quite sturdy, yet at the same time flexible and no more difficult to manipulate than any other suture material.

However, smooth silver wire is likely to slip easily and, instead of cutting or sawing through all fibers connecting growth and cornea, only the head of the pterygium might be pulled off, leaving a variable amount of pterygial tissue attached to the epithelial layer of the cornea. Such slipping can be avoided if the wire is transformed into a saw by cutting small corrugations into the smooth surface (fig. 1).

With this tough and adaptable tool, complete removal of the growth up to its tip becomes possible in one simple procedure, and not only the pterygial tissue, but also the superficial layer of the cornea with which it is inseparably fused, will be eradicated. Any instrument maker can easily corrugate a piece of silver wire. It should, however, be cautioned that the indentations must not be too deep, for the wire, if it becomes too thin, may not be able to stand the strain and may break during the operation.

Technique

For severing the head of the pterygium from the cornea, a piece of corrugated silver wire, about six inches in length, is grasped with a needleholder at a point about six mm. from one end. By means of fixation forceps

Fig. 1 (Tower). The smooth surface of No. 29-gauge silver wire has been interrupted by small corrugations, transforming it into a saw. (Highly magnified.)

the pterygium is lifted in the region of the limbus; then the underlying conjunctiva is pierced with the free end of the wire, which is passed beneath the neck of the growth, as close as possible to the limbus. For this purpose it is not necessary that the wire be threaded through a needle.

One end of the wire is grasped in each hand and, while an assistant holds the fixation forceps in such a position as to provide sufficient tension, the wire is manipulated to and fro underneath the corneal portion of the pterygium. If the wire is handled like a saw, undue pressure upon the head of the pterygium is avoided, and the growth will not merely be torn from the cornea. The see-saw movements of the wire will have to follow closely the curvature of the cornea to forestall deep penetration of this structure, while at the same time effecting complete eradication of all traces of pterygial tissue.

Results

Corrugated silver wire was used for severing the head of the pterygium in a series of more than 100 consecutive operations performed during the past 12 months.* The method proved highly effective in all cases,

* In Southern California, pterygia are much more often encountered than in the big cities along the Atlantic coast. Pterygial growths are comparatively more frequent among Mexicans and the colored population, and are also occasionally observed in school children between the ages of 8 and 14 years. The higher incidence of the disease is in all probability due to greater exposure to sun, bright light, and dust; no equally satisfactory explanation, however, is available to account for the fact that in this latitude neither temporal pterygia—which are extremely rare in other regions[3]—nor double pterygia can be considered to constitute unusual findings.

and the procedure was well tolerated by the patients. Postoperatively the cornea was clear, and no patches of pterygial tissue remained. Careful follow-up failed to reveal any recurrences up to the present time.

610 South Broadway (14).

References

1. McReynold, J. O.: The nature and treatment of pterygia. J.A.M.A., **39**:296-298 (Aug.) 1902.
2. ———: Some of the more difficult problems in the management of pterygia. Contributions to Ophthalmic Science. Menasha, Wis., Banta, 1926, p. 98.
3. Spaeth, E. B.: The Principles and Practice of Ophthalmic Surgery. Philadelphia, Lea, 1944, Ed. 3, p. 507.
4. Beard, C. H.: Ophthalmic Surgery. Philadelphia, Blakiston, 1914, Ed. 2, p. 358.
5. Stocker, F. W.: Operation for removal of pterygium. Arch. Ophth., **27**:925-928 (May) 1942.
6. Spaeth, E. B.: Rotated island graft operation for pterygium. Am. J. Ophth., **9**:651 (Sept.) 1926.
7. Wiener, M.: Surgery of the Eye. New York, Grune & Stratton, 1949, Ed. 2, p. 193.
8. Radzichovskii, B. L.: Separation of the pterygium from the cornea. Vestnik oftal., **17**:139, 1940. Abstracted in: Am. J. Ophth., **24**:591 (May) 1941.
9. Doherty, W. B.: A discussion of pterygia and report of a new technique for their removal. Am. J. Ophth., **24**:790-794 (July) 1941.
10. Gurley, L. M., Jr.: Pterygium transplant by simplified method. U. S. Nav. Med. Bull., **43**:1114-1116 (Dec.) 1944.

EVALUATION OF RECENT PROVOCATIVE TESTS FOR PREGLAUCOMA*

Paul Weinstein, M.D.

Budapest, Hungary

Since the dark-test of Seidel, usually positive in cases of prodromal glaucoma, the most frequently used test for every form of glaucoma is the water-ingestion test of Schmidt. In 1945, Bloomfield and Lambert reported a test for early diagnosis of simple glaucoma which they termed the lability test.

The present study was undertaken to attempt to refine the water-ingestion test and to investigate the accuracy of the lability test.

Meves, in 1940, published an improvement in the water-ingestion test, consisting of administration of Pituglandol, the hormone of the posterior lobe of the pituitary, simultaneously with the ingestion of water. The prolonged diuresis thus invoked increased the ocular tension and the effect of the provocative test became, therefore, more intense.

In 1946, Burn and associates reported on the antidiuretic effect of nicotine in rats. Burn found that, if the pituitary had been removed, nicotine produced no antidiuretic effect. Since it is well known that the smoking of a few cigarettes produces marked antidiuresis in man, these authors assume that the supraoptic nucleus of the hypothalamus, irritated by the nicotine, increases the hormonal output of the posterior lobe of the pituitary.

In order to verify the work of Burn and associates, we combined (in those patients

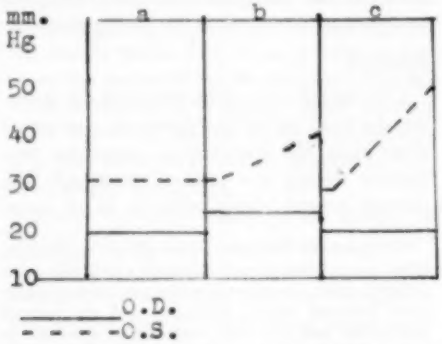


Fig. 1 (Weinstein). Composite graft of data obtained in 118 tests on 52 patients. (a) Water-drinking test. (b) Water-drinking test plus extract of pituitary. (c) Water-drinking test plus extract of pituitary plus three cigarettes in 15 minutes.

*From the Department of Ophthalmology, Hospital of the Jewish Community.

who smoked) the smoking of cigarettes with the water-ingestion test.

Figure 1 presents graphically the data obtained in 118 tests on 52 patients. The three provocative tests given to a patient suffering from simple glaucoma showed that the hormone of the posterior lobe of the pituitary makes the water-ingestion test a more sensitive one and that the smoking of cigarettes increases the subject's susceptibility to the test.

Procedure

In every case in which glaucoma was suspected, the patient was given one liter of tea the first thing in the morning while his stomach was empty. An extract of the posterior lobe of the pituitary (Exphysin, Pituisan, Glanduitrin) was then injected. If the patient smoked, he was asked to smoke three cigarettes within the next 15 minutes. An hour later the ocular tension was determined.

In 20 out of 22 cases of unoperated glaucoma, this test provoked a considerably increased ocular tension, as compared with the simple water-ingestion test. In two cases, the ocular tension was the same after each test. These findings would seem to suggest, as Ohm has pointed out, that there are intermittent glaucomas which show increased tension during certain periods.

In 14 cases of operated glaucoma, five cases demonstrated an unaltered tension with these tests, which would indicate that, in these five cases, the operation has produced perfect compensation of the glaucoma. In nine cases, although the hormone injection was omitted, the ocular tension was noticeably increased.

Control studies were made on 16 persons (aged 45 to 60 years) with no ocular complaints. A sudden increase of more than 6 mm. Hg (Schiøtz) in the ocular tension of five of these 16 control cases, following ingestion of water and injection of pituitary extract, pointed to preglaucomatous states. In not one of these five cases was there any reaction to the simple water-ingestion test. These findings should have important bearing in connection with the prevention of glaucoma.

Analysis of the findings in this study of the water-ingestion test combined with pituitary injection and cigarette smoking leave few doubts that the antidiuretic effect of the hormone and of nicotine cause water retention and thereby predispose to a rise in ocular tension.

Smoking would, therefore, seem to be a matter of concern to glaucoma sufferers.

It has been shown (Köllner) that hunger affects the daily curve of ocular tension. During the 20 years in which I have been observing cases of glaucoma, I have found that the complete fast of the Jewish New Year results in an increased number of glaucomatous attacks. Being in doubt as to whether the sudden rise in intraocular pressure was due to hunger or to the increased ingestion of food and drink following the fasting period, I conducted the following experiment.

Several patients with glaucoma were made to fast. Hunger did not change their tension readings. As has been reported (Gersch, Foulton), hunger and especially thirst cause hyperactivity of the secreting cells of the hypothalamus and this results in an increased amount of the antidiuretic hormone. It may be assumed, therefore, that an increased intake of food and drink after fasting, especially in combination with smoking, acts as a stimulant which may result in increased intraocular pressure.

The Bloomfield-Lambert lability test was used in 15 cases. This test very cleverly combines increase of influx into the eye with inhibition of outflow from the eye. The reliability of this test has been confirmed by Stine, Sugar, and Sykowski. We followed the method of Sugar, who combined the lability and the water-ingestion tests because, in his belief, the combined test was more effective than the lability test alone. In a number of the 15 cases tested, the results were positive.

Since the lability test is suited only to sus-

pected cases of simple glaucoma, we recommend the water-ingestion test combined with hormone injection and smoking because it is applicable to all types of glaucoma. However, in cases of simple glaucoma, the water-ingestion plus hormone and smoking test may be used in conjunction with the lability test.

Summary

The modified water-ingestion test herein described was used 98 times on 36 cases of glaucoma and 20 times on 16 controls. The results show that it was positive in 90 percent of the unoperated glaucoma cases. The 10-percent negative result suggests the possibility of an intermittent glaucoma. The results were positive in 60 percent of the operated cases of glaucoma; in the other 40 percent of operated cases, the glaucoma was well compensated. In 30 percent of the nonglaucomatous controls (aged 45 to 60 years) a preglaucomatous state could be detected by means of this test.

V., Szemelynok-u. 9-11.½3.

References

Bloomfield, S., and Lambert, R. K.: Arch. Ophth., **34**:83, 1945.
Bloomfield, S., and Kellerman, L.: Am. J. Ophth., **30**:869, 1947.
Bloomfield, S.: Arch. Ophth., **38**:368, 1947.
Burn, J. H., Truelove, L. H., and Burn, I.: Brit. M. J., **2**:403, 1945.
Köllner: Münch. med. Wchnschr., 229, 1918.
Meves, H.: Arch. f. Ophth., **142**:41, 1940.
Ohm, G.: Arch. f. Ophth., **135**:537, 1936.
Schmidt, K.: Arch. f. Augenh., **100-101**:190, 1928.
Stine, G. T.: Am. J. Ophth., **31**:1203, 1948.
Sugar, H. S.: Am. J. Ophth., **31**:1193, 1948.
Sykowski, P.: Am. J. Ophth., **31**:1305, 1948.

FERRIS-WHEEL ATTACHMENTS FOR BREWSTER TYPE STEREOSCOPE*

Emanuel Krimsky, M.D.
Brooklyn, New York

The aim in these attachments is to provide on a pair of circular disks a series of stereoscope pictures which can be rotated successively into position for viewing. These attachments consist of a right and a left portion, one for each target holder. In the model illustrated (fig. 1), each disk has six openings for holding 2 by 2-inch glass slides or 35-mm. slides. In the Krimsky† stereoscope, provision is made for fitting these disks over target frame holders in which are incorporated lamps to illuminate the targets from behind. These disks can also be readily removed. When each picture is moved in rotary fashion over the lamp area, it automatically clicks into place and assumes a levelled position with a corresponding target for the fellow eye. The pictures for each frame are numbered so that one is never at a loss to find the paired pictures for both sides.

By means of a handle which operates a right and a left hand thread, these disks can be separated so as to "diverge" the pictures as well as the eyes; or they can be approximated so as to "converge" the pictures as well as the eyes. Also, the disks can be brought synchronously closer to or drawn away from the eyes for selective increased or reduced accommodative ranges.

And, finally, with such a comprehensive

---

* Presented at the American Academy of Ophthalmology and Otolaryngology, Chicago, 1948.

† Arch. Ophth., **26**:808-815 (Nov.) 1941.

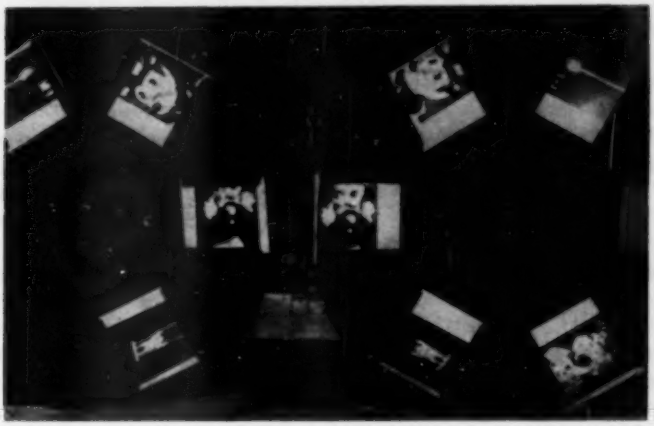


Fig. 1 (Krimsky). Paired circular disks for holding stereoscope targets.

set of targets on one disk, one can operate a diagnostic or a training series of targets without having to grope through a filing cabinet of pictures. The disks can be replaced by other disks. Also, one can choose smaller sized frame openings for smaller targets in which case a larger number of pictures can be used on one disk.

745 Eastern Parkway (13).

Ophthalmic Miniature

The older we get the more the transparency of the lens decreases. But, to produce an effect equal to that visible in Turner's pictures after the year 1831, pathological conditions are required. In the years that followed, as often happens in such cases, a clearly defined opacity was formed in the slight and diffuse dimness of the crystalline lens. In consequence of this the light was no longer evenly diffused in all directions, but principally dispersed in a vertical direction. . . . To be physiologically normal is not at all a fundamental condition in art; thus it seems to me perfectly natural that the peculiar poetical haze which is produced by the diffusion of light in Turner's pictures after 1831 should have a particular attraction for many of Turner's admirers.

R. Liebreich, *Effects of Faulty Vision in Painting*, 1872.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 20, 1950

DR. FOWLER HOLLABAUGH, *presiding*

RETROLENTAL FIBROPLASIA

DR. HENRY CARROLL SMITH said that, in his experience since 1945, 5 or 6 infants, born prematurely, have developed retrolental fibroplasia. This condition, as we all know, was first described and given its name by Terry in 1942. Terry's concept was that it was a membranous condition, coming from the tunica vasculosa lentis and the remnants of the hyaloid canal. Reese and others subscribed to Terry's belief and efforts were made to incise the membrane and thus restore vision.

Observing all premature infants at The Johns Hopkins Hospital, Dr. William C. Owens and Dr. Ella U. Owens found that the condition which was thought to be caused by an independently formed membrane was really a retinal change. The infants possessed normal optic fundi at birth. At an average of about four weeks after birth, dilatation of the veins and increased tortuosity of the retinal arteries appeared. Shortly after this, localized or generalized edema of the retina was found and the tissue developed a grayish-green color. The vitreous became cloudy and proliferating fibrous bands extended forward from the retina into the vitreous. The so-called retrolental membrane grew from fusion of these vitreous bands and the peripheral folds of the swollen, elevated retina. The progress of the disorder was usually finished by the end of the fifth month. After the membrane was complete, all vision was lost. In rare cases of retrolental fibroplasia, only a partial membrane formed and some vision was retained.

The patient presented by Dr. Smith was born after six and one-half months' gestation. It weighed three pounds, six ounces at birth. The mother had had no unusual illnesses during pregnancy. When the infant was 11 weeks of age, the parents noticed that the pupil of the left eye was smaller than that of the right eye and, shortly afterward, they observed a grayish-white pupillary reflex.

The first examination was made January 6, 1950, when the baby was four months of age. The right eye was apparently normal, with a good fundus reflex; however, the anterior chamber seemed a little shallow. The left eye presented a somewhat constricted pupil, shallow anterior chamber, a clear lens, and a grayish-white membrane occupying the space immediately posterior to the lens.

One month later, examination of the right eye showed a grayish fold extending from the periphery of the retina below to the equator of the lens. The right eye at this time seemed to possess greater dimensions than the left; apparently, the left eye was retarded in development. There were a few posterior synechias on the temporal pupillary margin of the left eye. One month later, there had been no apparent progress of the condition in either eye.

Owens and Owens reported (AMERICAN JOURNAL OF OPHTHALMOLOGY, 32:1631 (Dec.) 1949) a form of therapy which is based upon the theory that a metabolic abnormality in the infant itself may be the cause of the disturbance.

These investigators based their studies upon the knowledge that the main physiologic difference between premature and full-term infants is the defective fat metabolism of the premature ones. Because of this de-

fect, premature infants have been fed diets which were low in fat and high in protein. Such a diet would be deficient in vitamin E. Vitamin A, which is usually administered in natural fish-liver oil, increases the vitamin-E requirement of the infants; and iron which is administered because anemia develops in premature infants is known to destroy vitamin E.

Reduction of available vitamin E affects tissue oxidation. Since it is known that the retina has a higher rate of respiration than that of almost any other tissue, it seems reasonable to assume that lack of vitamin E might lead to development of retinal disease. I need only to refer you to the recent report of Owens and Owens for their results after supplementing vitamin E in the diet of premature infants. No doubt, many therapeutic measures will be proposed as investigation into this blinding condition proceeds.

Discussion. Dr. Herbert Duncan stated that he had seen three cases of retrolental fibroplasia at the Nashville General Hospital. One case developed glaucoma and the eye had to be enucleated.

Dr. Philip Lyle stated that, in making a diagnosis, toxoplasma should be considered.

Morris Adair,
Secretary-Treasurer.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

October 20, 1949

Dr. Perce DeLong, *chairman*

Meningioma of the tuberculum sellae

Dr. Benjamin M. Chambers (by invitation) said that patients with tumors in the region of the optic chiasm often are seen first by ophthalmologists because of disturbances in vision. Meningiomas in this region arise from the arachnoid villi of the meninges covering the circle of sinuses surrounding the sella diaphragm. The majority of meningiomas arise from the tuberculum sellae or the sulcus chiasmatis. Meningiomas are primarily fibroblastic in structure, are slow growing and do not invade the brain. Prognosis after complete removal of the tumor is good. When located in the region of the tuberculum sellae, visual-field defects may be the only significant finding. These defects may be variable, depending on the exact location of the tumor, the location of the chiasm, and the size and direction of growth of the tumor.

On X-ray examination, the sella turcica is usually normal; there may be erosion of the anterior clinoid processes and the tuberculum sellae. Pneumo-encephalography may indicate filling defects in the chiasmal cistern.

In considering the differential diagnosis of tuberculum-sellae meningiomas, one must rule out tumors of the hypophyseal stalk, craniopharyngiomas, suprasellar adenomas, tumors of the pituitary gland, meningiomas of the lesser and greater wing of the sphenoid, aneurysms of the internal carotid or of the anterior part of the circle of Willis, and optochiasmatic arachnoiditis.

On August 1, 1949, a 43-year-old white salesman was admitted to the Graduate Hospital with a history of progressive loss of vision in the left eye for five years and in the right eye for six months. There was no other complaint. The past history was essentially negative.

On admission, visual acuity was: O.D., 6/30, correctible to 6/15; O.S., light perception. Fundus examination of the right eye revealed the disc margins to be slightly blurred, the color slightly pale with the pallor more marked on the temporal side. The left disc margins were very sharp and the color very pale. Visual fields, on August 3rd, of the right eye revealed an irregular contraction involving mainly the inferior nasal quadrant. The remainder of the ophthalmic, somatic, and neurologic examination was normal. A Bárány test suggested

a supratentorial lesion in the midline.

All laboratory examinations were within normal, including the blood and spinal fluid Wassermann. Pneumo-encephalography revealed defects in the region of the tuberculum sellae suggestive of a neoplasm.

On September 20th, a meningioma of the tuberculum sellae was removed. The left optic nerve had been badly stretched by the tumor.

On the 11th postoperative day the visual acuity of the right eye had improved from 6/15 to 6/9; the visual field had expanded to approach the normal in size. There was no change in the left eye.

The case presented represents one in which the only complaints were of an ocular nature. Early recognition of the symptoms may well have resulted in preservation of sight in the now near-blind eye. This case should stress the importance of alertness and correct interpretation of findings by ophthalmologists in patients with an apparent unexplained loss of vision.

Discussion. Dr. Edmund B. Spaeth: I wish to recapitulate and repeat a few very important and significant points. This man was under the careful care of a competent ophthalmologist for five years. During those five years he became progressively blind in the right eye. He was in a sanitarium, and received shock treatment, because of a depressive state. The patient himself said to me, "You would be depressed also, doctor, if you saw yourself going blind, and nothing was stopping it."

He was admitted to the Graduate Hospital with no symptomatology whatsoever, either of a general neurologic or a medical nature, which would make one suspect pituitary dysfunction, or dysfunction in the neighborhood of the pituitary. He had, however, one persistent ophthalmologic sign, regardless of who did his field of vision, the technician, the resident, or one of the attending physicians. All found the same consistent defect in his field of vision. He was discharged from the hospital with a diagnosis of chiasmal arachnoiditis.

As said, he had no pituitary disturbance, and the electroencephalogram and X-ray studies were normal. An air encephalogram at another hospital and the ventriculogram at the Graduate Hospital were both negative.

After his discharge from the hospital, Dr. Trueman, Dr. Yaskin, and Dr. Groff were reviewing these ventriculograms. One of the three felt that the area of the tuberculum sella showed a convexity in the ventriculogram which was not normal. Because of that, a transfrontal craniotomy was done, and the tumor was found and extirpated very readily.

Dr. Chamber's differential diagnosis, I thought, was adequate though brief, and was very nicely presented. The two things to which he called attention and which this case showed so perfectly are the lack of symptoms in a tumor of the tuberculum sella and the marked similarity in this case with the so-called Foster-Kennedy syndrome which the patient really did not have.

Dr. Glen G. Gibson: I should like to congratulate Dr. Chambers for his detailed review of the characteristic signs and symptoms encountered in chiasmal lesions. He is correct in saying this is primarily the domain of the ophthalmologist. The point which Dr. Chambers is attempting to make is that these lesions are difficult to diagnose early in the course of the disease. It requires careful perimetry done by a physician to diagnose most of the lesions, since the majority do not present the classical bitemporal hemianopia until late in the disease. We are actually performing a neurologic examination of the second cranial nerve, and the demonstration of the defect and interpretation of the patient's responses is so complicated that this task, more than any other diagnostic procedure, is beyond the domain of the technician perimetrist.

The textbook signs of suprasellar lesions require careful evaluation. For example, headaches are mentioned as very important, when actually they are more likely to be absent than present. The characteristic field defect of complete bitemporal hemianopia is not frequently seen, and these cases should be recognized before that amount of visual-field loss occurs. The appearance of the disc, if not normal, is rather characteristic in that there may be a waxy pallor and the margins may be full or blurred—more so than in the intrasellar lesions, as shown in this case. The type of pallor stands out in sharp contrast to the dark-gray color of luetic optic atrophy. Central scotomas or bitemporal scotomas are common in these cases, and this is the mechanism that accounts for the loss of vision in this case.

The reason that early recognition in meningioma of the tuberculum sellae is important is that the growth is relatively easy to remove, and the return of function of the optic nerve is sometimes amazing. It is our responsibility to have confidence in our neurosurgical colleagues and urge operation. There is no other way of saving sight in these cases. The prognosis is much better now than it used to be and, consequently, it is our responsibility to recommend the correct treatment.

I have learned a number of points from Dr. Chambers' presentation, and wish to thank him for presenting it.

Fibrin closure in eye surgery*

Dr. Arno E. Town (by invitation) said that the principal aim of fibrin closure is to prevent the complications incident to a leaking wound by providing an even and quick-healing incision. Reformation of the anterior chamber begins immediately after the wound is sealed with fibrin and, in no case in which this technique of closure has been used, has there been a delay in the restoration of the anterior chamber. In addition, the hemostatic property of the thrombin should lessen hemorrhage into the anterior chamber. Furthermore, the traumatism caused by the introduction of corneoscleral sutures and the postoperative removal of them is averted. It is felt that a perfect closure will decrease the incidence of the dreaded postoperative complications of epithelial invasion of the anterior chamber.

Sealing of ocular wounds with fibrin is secure, rapid, and produces an even-healing wound. The number of postoperative, leaky wounds is reduced, and the danger of hemorrhage, epithelial downgrowth, iris prolapse, and separation of the retina may be lessened. This technique of wound closure is applicable in cataract and glaucoma surgery, in keratoplasty, and in traumatic and plastic surgery.

Discussion. Dr. Carroll R. Mullen: Dr. Town's paper brings up-to-date all the work that has been done on this interesting ophthalmic subject. It is comparatively new to many of us. He developed the techniques which he found best. He has quoted the experience of other physicians who have used fibrin in the closure of surgical wounds.

All of the work reported is that of clinicians, and they appear to be quite satisfied with present procedures. Unquestionably the future holds great promise for this newer method of wound closure. When more cases have been subjected to this type of treatment a detailed report on the complications will be most interesting. We should like to hear at that time the observations on the arrest of epithelial downgrowth, prolapse of iris, hemorrhage, and secondary glaucoma.

One of the most serious periods after cataract surgery is during the first night. Older patients sometimes encounter serious complications with restlessness and physical activity associated with mental alterations.

* This paper was published in full in the American Journal of Ophthalmology, 33:879 (June) 1950.

It would be of great importance to know if the use of fibrin will give greater security in preventing postoperative complications in these first 24 hours over and above that now enjoyed by the use of corneoscleral sutures.

We would like to know if this physiologic glue could be used to augment the present suture treatment employed by many surgeons. In Chicago, at the Academy meeting, Dr. Brown of Cincinnati reported his experiences with about 30 cases of unselected detachments of the retina. These cases were all of poor selection, because the experiment was not considered in patients who had some chance for surgical repair of the separation with accepted methods. He augmented the usual diathermy treatment of detachment with the use of physiologic glue. He reported adhesions did not occur well on a wet surface. However, results were about 60 percent recovery, meaning re-attachment of the retina; 30 percent were improved, and the other 10 percent did not improve. This is encouraging, and should leave the avenue of investigation in this field open.

Dr. Tassman reported his own very satisfactory results in keratoplasty. It might be that this type of closure in keratoplasty may offer a barrier to ingrowth of vessels.

Dr. I. S. Tassman: This is a comparatively new procedure, especially for use in ocular surgery. It is not long out of the experimental stage. I would like to compliment Dr. Town for his presentation this evening. I am in a position to state that we have here a new procedure, which will provide adhesion of edges of a wound. It might be considered at the present time as an adjunct in our technique for wound closure, because wound edges will heal more readily and more quickly with the application of this so-called physiologic glue.

There is no question about the gluelike property of this mixture. When one or two drops of thrombin solution is added to one drop of the patient's plasma, there is an immediate reaction. A mucilagenous or gluelike coagulum forms. This coagulum seals the wound and provides an immediate adhesion of wound edges. It is most useful, as Dr. Town pointed out, in cataract operations to augment immediate closure after extraction of the lens; in corneal wounds, even without the use of a conjunctival flap, if the wound does not gape too much; in the closure of the conjunctiva after ocular muscle surgery particularly in children; and in keratoplasty.

It is particularly useful in keratoplasty. Having employed this method in a number of cases to date, I am convinced that the corneal grafts can be made to adhere. After cataract extraction, the anterior chamber can be seen to reform within 30 minutes. This can also be observed in some cases of keratoplasty before the operation is completed with the use of sutures.

There is one point, however, if I understand Dr. Town correctly, in which I differ slightly. I would not advocate the elimination of the use of sutures in cataract operations, because of this method. I still think that we need cataract corneoscleral sutures for the security that is provided during the course of the operation. At the completion of an uneventful operation, the application of glue will seal the wound and provide more immediate closure and adhesion of the edges. Postoperative complications are also minimized. We still need a suture, however, during the course of the operation for the security that it will provide in the case of accident. It can also be employed in cases of incomplete wound closure several days after cataract operation. When this results in a flat anterior chamber, the application of plasma and thrombin solution will seal the wound and result in reformation of the chamber.

Dr. Mullen mentioned the possibility of complications. I am sure that this is an absolutely safe procedure. There are no complications which can result from its use.

With regard to epithelium downgrowth, the sealing of the wound and immediate ad-

hesion of the edges at the time of operation will prevent this. It should be prevented in cataract operations as well as in any other corneal sections whether traumatic or otherwise.

In cases of keratoplasty, the only thing that can be accomplished by the sutures is holding the graft in place and maintaining it in position. Sutures cannot provide adhesion of the edges of the wound. Here, however, we have a method which will provide immediate fixation and adhesion so that healing will take place normally and union will occur more readily, more quickly, and more surely.

(A number of slides were presented, illustrating the results obtained in cases of keratoplasty with the use of this method. These were cases of old interstitial keratitis, one case of corneal dystrophy, and one case of keratoconus. In three of the cases, the plasma and thrombin were employed in addition to the use of sutures while in the others it was employed without the use of sutures.)

In cases of keratoplasty, other additional factors are concerned in determining the final visual result, but the purpose here is principally to demonstrate the adhesive property of the fibrin coagulum in providing almost immediate adhesion and maintaining that adhesion through the postoperative course. It is very possible that in the future the procedure may be improved. In fact, I have one or two thoughts in mind which may provide an improvement in the preparation and technique. However, at present, I think that this method does provide a means for obtaining more immediate fixation and adhesion of the edges of corneal wounds in particular.

Dr. Edmund B. Spaeth: My experience in the use of thrombin and plasma has been wholly with skin grafts and, in those instances, it is of tremendous assistance and importance. In the full-thickness skin grafts, by use of this physiologic glue, one can eliminate entirely the use of sutures.

I was happy to hear Dr. Tassman use the word "adjunct," and not advise discontinuance of the use of sutures for intraocular surgery.

It has been our experience, demonstrated by the investigation of cases, that it is not the intracapsular or extracapsular procedure which predisposes to retinal separation with aphakia. This follows surgery regardless of whether it is one or the other. Complications of cataract and the very likely predisposition that these patients have to uveitis is the disposing cause for retinal separation with aphakia. A stormy postoperative recovery, regardless of the type of cataract, after a lens extraction is another predisposing factor.

Dr. James S. Shipman: I would like to say a few words concerning the discussion that has been given regarding the use of this material, fibrin, in retinal detachments.

I heard Dr. Brown's paper in Chicago, and also his discussion of Dr. Tassman's paper here in Philadelphia last May at the Wills Hospital conference. I think some people may have the idea that Dr. Brown used fibrin alone in the cases of retinal detachment which he reported. I would like to point out that Dr. Brown specifically stated that he used the fibrin in conjunction with the electrocoagulation technique, and that his purpose in using the fibrin was only to hold the retina in contact with the choroid for a sufficient time to allow the coagulation areas to become adherent to the retina.

To my mind, this is not necessary, and this procedure is adding a great deal more difficulty to a procedure which has become more or less established and is comparatively simple; namely, that of electrocoagulation as devised by Gonin and later modified and developed by Safar, Lindner, Gueist, Weve, Walker, and many others in this country. I feel that this technique still holds the preëminent position in the treatment of retinal detachment and that it will continue to do so for many years.

I am in agreement with Dr. Tassman and Dr. Spaeth that sutures in cataract surgery should not be entirely dispensed with and that, if fibrin is used in this type of ocular surgery, it should be used as an adjunct to sutures.

I have enjoyed this presentation, and I feel that Dr. Town is to be complimented on the work which he has done, and I admire him for his faith in this material and his willingness to use it instead of sutures. Certainly, most of us did cataract surgery for many years without sutures or any material of this type, and the ultimate results were not too unsatisfactory. I thing Dr. Tassman is also to be complimented for his work with fibrin in corneal transplants, and it is my opinion that fibrin will be of most value in this type of surgery.

Dr. William E. Krewson, III: I would like to ask Dr. Town a question—In cataract surgery, where you get almost an instantaneous closure of the wound with this method, do you ever have trouble in the toilet of the wound such as inserting an iris spatula or the tip of an irrigator, if necessary?

Dr. Arno E. Town: First to answer Dr. Krewson's question. We don't use the fibrin until after the toilet of the wound is completed and the iris is replaced. May I show four slides?

The first slide* will demonstrate the conjunctival incision which is advocated by Dr. Theobald and Dr. Hass in which the incision is placed quite a long distance back of the limbus.

The second slide is an attempt to demonstrate what I was saying about the keratome incision being circular instead of being tangent. In other words, we should have an incision which is curved and which has the same curvature as that of the cornea.

The next slide is a demonstration by Dr. Atkinson to show how the wound should be bevelled. You notice the lower keratome incision is along the plane of the iris. He advocates bevelling it at the upper incision.

The next slide is a photograph of the keratome, which we use. It is pretty hard to photograph a keratome to show the curvature on the anterior surface. This is just the opposite from the keratome which Berens uses for glaucoma surgery. Berens's keratome has a curvature on the posterior surface.

* See American Journal of Ophthalmology, 33:881 (June) 1950.

Influence of drugs on the restoration of intraocular pressure

Dr. Irving H. Leopold and Dr. Robert Day (by invitation) discussed the influence of drugs on the course of the intraocular pressure following paracentesis of the anterior chamber of normal rabbit eyes. The drugs tested by local instillation were pilocarpine nitrate, furmethide, mecholyl hydrobromide, eserine sulfate, di-isopropyl fluorophosphate, adrenalin, and neosynephrin. Etamon, priscol, dibenamine, and benadryl were given intravenously. The influence of various combinations of drugs, such as D.F.P. and adrenalin, mecholyl and adrenalin, eserine and adrenalin, was studied.

The results revealed that the cholinergic drugs and the anticholinesterase agents increased the initial rise in intraocular pressure after paracentesis and prevented the secondary rise. The adrenalinlike compounds prevented or diminished the primary and secondary rises of intraocular pressure seen in the normal eye. The adrenalinlike compounds also prevented or diminished the intraocular-pressure effects of the cholinergic and anticholinesterase drugs. The sympatholytic drugs increased the primary rise in intraocular pressure after paracentesis. Antihistaminic drugs diminished slightly the primary rise in intraocular pressure after paracentesis. Their influence was not as marked in this respect as the adrenalinlike compounds. Dibenamine produced an effect unlike that of other sympatholytic compounds.

These studies suggest that cholinergic and

anticholinesterase agents increased intraocular small-vessel caliber and also permeability, and that the power of the adrenalin compounds to produce vasoconstriction could overcome the vasodilation stimulus of paracentesis plus that of cholinergic and anticholinesterase drugs.

Theoretical and practical applications of these studies were suggested, and attention was especially directed to the merit of the combination of cholinergic and sympathomimetic drugs in glaucoma therapy.

The drugs employed in this study have been limited to those which are known to have an effect on ocular tension. The explanation of their actions has been limited, in the main, to their vasomotor effects. The reasons for this are twofold. First, there is no evidence that secretion of aqueous humor occurs following paracentesis and, secondly, it is felt that the results obtained can be adequately explained by the vasomotor effects without assuming any secretory effect.

The method employed was not exact. The determination of ocular tension in rabbits with a Schiøtz tonometer is not easy. However, it was found that the results obtained were reproducible and agreed with studies previously reported. As an example, the effect of atropine in producing an initial rise in tension higher than in control eyes, followed by a secondary rise, was similar to the results reported by Duke-Elder.

It is hoped that this will stimulate further investigation of these drugs, which will lead to a better understanding of the treatment of glaucoma.

Discussion. Dr. I. S. Tassman: I should like to ask Dr. Leopold how he would suggest using priscol and etamon in a clinical way in some of the cases in which it might be indicated. I do not doubt that there is a clinical use for these drugs. Priscol and etamon in particular are comparatively new drugs and have not had a wide use. They are known for their properties of vasodilation, and might have value in patients with vascular hypertension and, perhaps, also in diabetes. I think it would be worth while to have Dr. Leopold enlarge on that.

Dr. Irving H. Leopold: Priscol and etaman can be used in ocular cases where one would like to obtain marked vasodilation. However, it should be kept in mind that these drugs greatly lower general blood pressure and, therefore, their use should be restricted to those patients who can withstand a marked depression of systemic blood pressure. They can be given parenterally, or can be taken by mouth. Priscol comes in 50-mg. tablets. Etamon comes in approximately the same dose. One can give as much as 3 or 4 mg./K. parenterally. These vasodilators may be tried in retinal-artery occlusion of short duration, and in the fundus conditions in which it is felt that the retinal or uveal circulation might benefit from vasodilation. This is a subject for further study, and, with the exception of the French literature, there have been very few reports of the merits of these drugs in ocular therapeutics.

M. Luther Kauffman, *Clerk.*

COLORADO OPHTHALMOLOGICAL SOCIETY

September 17, 1949

Dr. Leonard Swigert, *president*

Eye changes associated with convulsions

Dr. George Stine presented the case of S. R. J., a 62-year-old woman who, two to three years before, had developed convulsive seizures mainly in the early morning hours, intermittently recurring every 10 to 21 days. After one such attack low blood sugar was found. Of glucose tolerance tests done later, two were normal and two showed severe hypoglycemia. Examination showed no evidence of pancreatic adenoma. X-ray studies showed a pronounced degree of hyperostosis

frontalis interna. Convulsive seizures were controlled with mesantoin. In the past two years the patient has had intermittent auricular fibrillation and periods of congestive failure. The patient has taken digitalis for the past 18 months with fair control of the heart problem.

Dr. Stine first saw this patient in August, 1944, when corrected vision was: R.E., 0.9; L.E., 1.1. The patient then showed incipient cortical cataract and no other pathologic condition. In March, 1947, at the time of hyperinsulinism and low blood sugar, pupils were slightly sluggish; vision was blurred but corrected to 0.9, O.U. Lenses and fundi showed no change. Visual fields were normal. In October, 1948, the best vision was R.E., 0.5; L.E., 0.4. There was a slight increase in lens opacities; fundi were normal. Visual fields showed marked concentric contraction to less than 10 degrees. At this time the diagnosis of retrobulbar neuritis was made, etiology unknown. X-ray films at this time showed marked thickening of the inner tables of the skull (hyperostosis interna frontalis).

The patient was next seen in September, 1949, when vision was 0.6, O.U., pupils and fundi were normal, and a marked improvement was found in the visual fields. X-ray studies showed both the optic foramina to be larger than normal—the right, 8.0 mm. in diameter, the left, 9.0 mm.—and irregular in outline. Dr. Stine stated that he felt pressure variations due to the hyperostosis were responsible for the eye changes.

Discussion. Dr. Joseph Kafka said that fasting patients may suffer visual loss and refractive changes related to hyperinsulinism or hyperglycemia which, under proper care, clear up in a week. In answer to questions by Dr. William Bane and Dr. Donald O'Rourke, Dr. Stine said that hysteria and digitalis poisoning had both been considered and ruled out.

Aphakic correction

Dr. Stine also reported the case of a 43-year-old man who, in 1941, had a left lens extraction for cataract and subsequent vision of 1.1. In 1949, the patient was seen with a mature cataract in the right eye, acute glaucoma, milky aqueous, and tension of 73 mm. Hg (Schiøtz). After paracentesis and foreign-protein therapy, the right lens was removed. They eye recovered, became 35 degrees divergent, and showed 0.7 vision with diplopia. Nevertheless, glasses were prescribed in April, 1949. By September the eyes were straight; vision was 1.1, O.U.; there was no diplopia.

Scleritis nodosa

Dr. Fritz Nelson presented the case of F. S., a white woman, aged 41 years. The left eye had been enucleated 14 years ago apparently for a condition similar to the one that later affected the right eye. The right eye became inflamed in 1937. She was first seen by Dr. Nelson on March 26, 1941. At that time she presented a scleritis nodosa with nodules up to 15 mm. in diameter.

All laboratory and other tests were consistently negative, including Kahn and tuberculin reactions. She was treated with subconjunctival air injections and with repeated mild doses of X rays, (1/15 of a skin erythema dose). She also received sulfanilamide and neoprontosil at that time. The condition cleared gradually and by the end of May the eye was almost normal.

She had a recurrence in August, 1942, which also cleared up after some weeks of similar treatment. In February, 1943, a small scleral nodule appeared in the 11-o'clock meridian followed by several more nodules. The eye then stayed quiet until August, 1946, except that small nodes appeared occasionally. In January, 1947, the patient developed a small corneal ulcer in the 6-o'clock meridian, between the center and limbus, which cleared up rapidly after steam cautery.

In March, 1949, another attack of scleritis occurred. This time the inflammatory process was violent and a tongue-shaped keratitis from the nasal side and lower temporal quadrants appeared. The picture was that of

keratitis scleroticans. The patient was hospitalized and received aureomycin, streptomycin, and penicillin which seemed to influence the process. After a while she reacted violently, with a rash all over the body which made it necessary to discontinue the medication. A short while later she took one tablet of aureomycin and again reacted with a violent rash. Recently she developed a new flare-up in the lower part of the eye where a rather pointed nodule appeared close to the limbus in the 6-o'clock meridian. For this she was treated on June 13, 1949, with another X-ray dose. She also had local treatment with sulfacetimide drops (30 percent).

The numerous recurrent attacks of scleritis which now are not very painful have disfigured the globe considerably. There are bulging sections and depressions. The corrected vision is still 20/30 minus. However the refraction frequently changes, probably due to the changing of the shape of the sclera. The cause of this patient's disease is still unknown.

Discussion. Col. A. Vadala of Fitzsimons General Hospital suggested the use of histamine (0.225 mg./cc., 4 to 6 drops 10 times a day). Dr. George Stine suggested biopsy for sarcoid and the use of calciferol. Col. J. Martin, Fitzsimons General Hospital, stated that, in a similar case, a biopsy showed chronic lymphoid hyperplasia.

Bilateral cataracts

Dr. William Kuhlman presented a six-year-old boy with bilateral cataract, congenital, axial, posterior polar. This youngster with glasses and daily use of homatropine has vision of: R.E., 20/40; L.E., 20/30.

Discussion. Dr. Fritz Nelson stated that such treatment can do no harm regardless of age of patient. Dr. William Droegemueller suggested optical iridectomy. The consensus of the members was that whichever of these procedures would satisfy the patient's visual requirements as time went on should be carried out until extraction became necessary.

Dr. Kuhlman, also presented a woman, 25 years of age, who was found to have bilateral congenital cataracts resembling doughnuts in distribution of the opaque areas. The visual axes were clear and vision was 20/15 unaided, each eye. No other ocular pathologic condition was present.

Thomas M. Van Bergen,
Recorder.

Ophthalmic Miniature

> From my general check up on what the books had to say and by my own observation of the facts themselves, I found that scientists—except in the rare cases of really great minds—are human like everybody else, without any advantage other than that of having prepared themselves adequately for research under illustrious teachers and in the warm greenhouses of the scientific schools.
>
> Santiago Ramon y Cajal.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

EDITORIAL STAFF

DERRICK VAIL, *Editor-in-Chief*
700 North Michigan Avenue, Chicago 11

WILLIAM H. CRISP, *Consulting Editor*
1276 Emerson Street, Denver 3

LAWRENCE T. POST, *Consulting Editor*
640 South Kingshighway, Saint Louis 10

WILLIAM L. BENEDICT
The Mayo Clinic, Rochester, Minnesota

FREDERICK C. CORDES
384 Post Street, San Francisco 8

SIR STEWART DUKE-ELDER
63 Harley Street, London, W.1

EDWIN B. DUNPHY
243 Charles Street, Boston 14

F. HERBERT HAESSLER
561 North 15th Street, Milwaukee 3

PARKER HEATH
243 Charles Street, Boston 14

S. RODMAN IRVINE
9730 Wilshire Boulevard,
Beverly Hills, California

JAMES E. LEBENSOHN
4010 West Madison Street, Chicago 24

DONALD J. LYLE
601 Union Trust Building, Cincinnati 2

WILLIAM A. MANN
30 North Michigan Avenue, Chicago 2

JOHN V. V. NICHOLLS
1414 Drummond Street, Montreal

ALGERNON B. REESE
73 East Seventy-first Street, New York 21

PHILLIPS THYGESON
87 North 6th Street
San Jose, California

M. URIBE TRONCOSO
500 West End Avenue, New York 24

ALAN C. WOODS
Johns Hopkins Hospital, Baltimore 5

KATHERINE FERGUSON CHALKLEY, *Manuscript Editor*
Lake Geneva, Wisconsin

Directors: WILLIAM L. BENEDICT, *President;* FREDERICK C. CORDES, Vice-President; WILLIAM A. MANN, Secretary and Treasurer; WILLIAM H. CRISP, LAWRENCE T. POST, DERRICK VAIL.

Address original papers, other scientific communications including correspondence, also books for review to *Dr. Derrick Vail, 700 North Michigan Avenue, Chicago 11, Illinois;* Society Proceedings to *Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Manuscripts should be *original copies,* typed in *double space,* with wide margins.

Exchange copies of medical journals should be sent to *Dr. F. Herbert Haessler, 561 North 15th Street, Milwaukee 3, Wisconsin.*

Subscriptions, application for single copies, notices of changes of address, and communications with reference to advertising should be addressed to the *Manager of Subscriptions and Advertising, 664 North Michigan Avenue, Chicago 11, Illinois.* Copy of advertisements must be sent to the manager by the 15th of the month preceding its appearance.

Change of address notice should be received not later than the 15th of the month prior to the issue for which the change is to go into effect. Both old and new addresses should be given.

Author's proofs should be corrected and returned within forty-eight hours to the *Manuscript Editor, Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

INCOME-TAX DEDUCTIONS FOR KICKBACKS

For many years the reprehensible practice of giving and accepting rebates has flourished almost openly. One cannot lay most of the blame on opticians because they are business men and making financial concessions for the purpose of increasing volume of business is part of the practice of many trades. The argument against kickbacks is largely ethical unless one accepts the principle that protection of the public is a governmental duty and that actions contrary to the interest of the people are opposed to national policy and hence actionable.

It was on the supposition that kickbacks on optical goods and other medical supplies were disadvantageous to patients that such practices were long ago declared unethical for physicians. Therefore, the initiative of the suppression of the practice has fallen on the doctors themselves and the feeble efforts of a few have availed little against the many who have yielded to the tremendous incentive to

fill their coffers at the expense of the patient.

At last real encouragement has been given to the crusaders against rebating by a recent court decision in this matter. In the past many half-hearted attempts have been made by the American Medical Association. Committees appointed by it to investigate the practice of rebating and to make suggestions have met with little encouragement when recommendations were sufficiently concrete and exacting to have any salutary effect. If action was confined to vague generalities and threats without teeth, committee reports have been accepted, but when harsher measures have been proposed, such as the annual inspection of the income tax returns of 10-percent, by lot, of the membership of each county medical society with provision that, where evidence of accepting of rebates was found, action must be taken by the society against the physician and said action must be reported to the central body within a limited period of time, acceptance of such recommendations has been denied.

The government on its part has failed to carry to court the indictments brought against companies and individuals for giving and receiving kickbacks. It has been satisfied to accept admissions of having participated in these practices and pledges to desist from them. This may be satisfactory in individual cases, but does not set any precedent to which one can turn for future action and, from what comes over the grapevine, it has scarcely deterred the practice among those who were not directly involved. In other words, the matter is still in the air and the observer cannot help feeling that a tremendous lot of ado has resulted in a minimum of accomplishment.

It was recently reported that two companies who claimed deductions in the neighborhood of $160,000 for expenses incurred in doing business which, though disguised by verbiage, were obviously kickbacks to ophthalmologists, were judged to be in error in making such claims. The court ruling, apparently a majority opinion of two out of three judges, was that, though confusing terms were used, in essence the expenses were rebates and that though no law directly covered this practice, it was deemed to be against public welfare and the claim of the companies was disallowed.

The dissenting judge pointed out that no law exactly applicable to rebating was on the statutes and that no evidence had been presented to show directly that the cost of glasses was increased by aforesaid kickbacks and finally that it had not been the practice of the United States to consider the source of income as a determining factor in levying income taxes against such income. The last point was evident at the time that bootleggers were fined and imprisoned not because their source of income was illegal, but because they had failed to declare the income in their income tax returns.

The points made by the minority opinion seem to me, unfortunately, to be pertinent and I question whether the majority opinion will be upheld if the case is appealed to a higher court. However, the decision may not be questioned or, if appealed, may possibly be affirmed, in which case it would serve as a precedent to which reference could be made and it would surely be a serious deterrent to the practice of giving rebates because few companies could afford the tremendous extra cost to them of dispensing glasses if rebating were not a deductible item for income tax purposes. This may be only a straw in the wind, but if it means that government appointees were prepared to render verdicts against kickbacking, something worthwhile may eventuate.

It would seem that what really is needed is evidence to show that glasses could be dispensed cheaper to the patient if rebates are not given than if they are given, and a law, based on this evidence, to prohibit the giving of kickbacks because they unnecessarily increase the cost to the patient. Much evidence has reportedly been collected to prove that the giving of rebates increases the cost of glasses, but there are so many factors that

7

control cost of glasses that this single item may easily be lost in evaluating the whole picture.

As this editorial is being written, our country has become involved in the Korean war which may easily be the brushfire that starts the forest fire which will once more ignite world conflagration. Obviously, if this happens, such minor matters as kickbacks will be deferred along with even more important ones, such as the struggle over the socialization of medicine with its undemocratic compulsory health scheme. A minor advantage might be the development of better plans by leaders of the medical profession for overcoming the defects in our system of medical care that have occasioned the demand for socialization.

As of this moment, however, we can only hope that opticians will all hear of this court decision and agree that they can no longer afford to share with the ophthalmologists the profit from the sale of glasses.

Lawrence T. Post.

CORRESPONDENCE

Destruction of the Macula by Indirect Violence

Editor,
American Journal of Ophthalmology:

Lesions of the globe by concussion, resulting from the displacement of the air at a distance from an explosion or from violent oscillatory traction caused by a sudden jerking motion of the soft parts of the orbit, under the influence of traumatisms of the bony facial structures, are likely to be seated in the posterior, and especially in the macular, region of the globe, very seldom in the retinochoroidea. They may result, also, from a sudden slight stroke on the anterior part of the eye; and occasionally from radiating fractures about the optic foramen.

At the time of the first World War lesions of the internal membranes of the eye were not very well understood—they were subject to the results obtained by systematic methods of examination and by the facts of the case elicited by a careful investigation of the events connected with the occurrences when blindness was first noticed.

It was within the experience of soldiers in action on the battlefield that the air about them would be shaken by explosions from gunfire even when the explosions occurred at a great distance. Their whole body might be shaken, the effect being likened to the vibration of the walls of the room or of an open door when a heavy truck rumbles by.

It is, perhaps, not without interest in this connection to state that there were some cases under observation of individuals whose faces presented the scars of lacerations, or of contusions, whose central vision had been lost but whose macular regions presented no visible lesions. Such cases could be explained only by a knowledge that there might be conditions which cannot be revealed, immediately, by the ophthalmoscope. We should not consider such a one as being a malingerer despite the fact that the central scotoma cannot be accounted for.

Several cases of macular destruction have been under my observation in my time, and I cannot refrain from offering to you a brief summary of the events of their stories, some as told by soldiers sent back to America, and others in civilian practice.

The first is that of a girl, aged 12 years, who, one summer day, while playing with her younger brothers in climbing the trees of their estate, fell to the ground violently striking her head. She was unconscious for a half hour or more. On recovering, while walking to the house, she cried out that she could not see out of her right eye. She, with all her family, had been under my care for years—none had ever before had any serious anomaly. The eye was without central vision, only hand movements could be made out in the peripheral fields. The left eye was as active as ever it had been. No unnatural signs were visible on the right globe, but the fundus, viewed through the clear media, showed the

macular region as though the fovea had been punched out from the surrounding retina. It appeared as a reddish gray disc about three fourths of the diameter of the optic disc. The retina was without visible changes; there were no clots or other signs of deeper involvement.

Desiring consultation, I took the patient to Dr. de Schweinitz, whose opinion confirmed my own, that it was a "hole." During our conversation, he humorously remarked, "Maybe a new macular region might develop for, you know, someone has declared that can happen." Such a happy result did not follow. Several years later visual acuity had increased to 5/40, vaguely, in the periphery.

Before leaving Dr. de Schweinitz, he called to my memory the case which created a bit of notoriety in medical circles in this city—of that related by a man who, while walking along the street near 9th and Spring Garden, was knocked down by unseen forces, stumbling to the pavement and who, on recovering, declared he could not see. He remarked that he had been somewhat shocked by a noise as from a distant explosion. This was in the late 1890's. There had been a series of explosions at the Atlantic Oil Refinery at Point Breeze, on the lower Schuylkill River. The man came to the Wills Hospital—I can't remember by whom he was brought into the clinic where I was working. I recall that the macular area was like another optic disc in size and shape, and, of the unreadiness of my elders to believe that the far distant explosion had knocked the man down. The case has been vividly in my memory, but I have no written record of it.

Dr. de Schweinitz recalled, also, my having had under observation soldiers returned from Europe who had lost their sight during warfare. You, perhaps, know that General de Schweinitz was the consulting ophthalmologist of the combined forces throughout the first war. His remarkable memory of all subjects connected with medical events allowed nothing to escape his powers of recollection.

During my service at General Hospital No. 11, at Cape May, New Jersey, several detachments of soldiers who had been blinded were assigned to our staff. Among these were eight whose condition had been manifested without satisfactorily explained causes. On some of the accompanying records was noted "malingerer."

Their stories of events leading up to their disability were quite similar; that is, that while on duty, in actual combat, they were suddenly knocked down, stumbling to the ground, during distant active big-gun explosions. No two of the patients had been together, nor had they been affected at the same hour. But, each claimed that the windage of flying missiles, and the concussion of the air following the distant explosion violently affected them.

None of the group to which I refer exhibited wounds of the eyeballs and none of them was totally blind. But the eyegrounds of one eye presented in the posterior pole destruction of the macular region. One or two showed clearly a marked punched-out appearance; others, equally sharply rounded with lacerations extending into the discoid area. In no one was there laceration of the retinochoroidea, or demonstrable detachment of the retina.

So desirous was I that Dr. Walter Parker, then colonel in charge of the ophthalmologic service of the Army (forced to be confined in the office in Washington), should see these patients, that I wired an urgent request for him to be sent to Cape May for consultation concerning the seriously affected soldiers consigned there.

After some delay, Colonel Parker arrived and, while actually studying the cases, cries throughout the hospital that the war was over quite demoralized all attempts at quiet examinations of the men in the examining room. All clamored to be discharged. Pandemonium existed. It was the day of the "False Armistice."

All efforts at strict discipline were futile. Soon the men began to leave the hospital, either by discharge or on furlough, and I

could not pursue my study of them. None had recovered the sight of the affected eye.

While I was amazed at the showing of so many cases, I had been prepared for the occurrence of damage to the eyes by concussion of the air following distant gunfire, by the remarkable pictures of eyegrounds in Lagrange's *Atlas* which had been made from his studies of the wounded in the French army—remarkable, to, for the speed with which the materials had been gathered and the book published, containing an English translation by Sir John Parsons, and thus made available for use in the United States forces.

I helplessly regretted that I could not have had the power to reproduce what I saw in these cases, and others, to illustrate what was visible. I would, however, offer two films to give an idea of what the lesions were like. The first, taken from Haab's small *Atlas*, shows a clear, punched out region, which the author believed followed a blow on the front of the eye. The other is from Lagrange's *Atlas*. That eye was damaged by concussion of the air during a far distant explosion in gunfire.

Haab's case of a "Hole in the macula" looks like a deep red disc at the site of the macula, the surface seeming to be deeper than the general retinal level.

That so serious a destruction of the vital portion of the globe should follow such "accidents" as were so ascribed, is an incomplete mystery. Perhaps the soft parts of the orbital contents were shaken, so much so as to twist the optic nerve, causing it to stretch the posterior pole of the globe. As I have not had a case, subsequent to these I have told you about, since 1918, I am still wondering at their occurrence. I have no formal records to offer. These have been harbored in my memory.

(Signed) Burton Chance,
Philadelphia, Pennsylvania.

BOOK REVIEWS

PROCEEDINGS OF THE FIRST CLINICAL ACTH CONFERENCE. Edited by John R. Mote, M.D. Philadelphia, The Blakiston Company, 1950. 178 contributors, 624 pages, 414 illustrations, no index. Price, $5.50.

The volume contains 52 papers presented at the first conference on ACTH and cortisone sponsored by Armour and Company, in October, 1949. The well-known authors discuss their experiences with the experimental use of these extraordinary substances in a wide variety of clinical conditions, including rheumatoid arthritis.

The most valuable contribution, so far as those who have not, as yet, had the opportunity to use these drugs are concerned, is that dealing with the fundamental problems of metabolism and the glands of internal secretion.

By now, many physicians in the United States are aware of the indications and something of the contraindications of these substances. The side effects are being recognized and registered. But in this volume are the first fruits of study and investigation by those qualified by experience and training to evaluate these marvelous materials. Therefore, this book should be the foundation stone upon which our future structure of knowledge is built.

It is profusely illustrated and charted. The lack of an index is a minor flaw, but the table of contents is a fairly adequate substitute.

Derrick Vail.

CLINICAL ORTHOPTIC PROCEDURE. By William Smith, O.D. Saint Louis, C. V. Mosby Company, 1950. Clothbound, 393 pages, 70 illustrations. Price, $8.00.

In the preface, Smith states that his attempt in writing the book has been one of presenting an orderly and systematically arranged compilation of material on orthoptic procedure based entirely on clinical results.

Throughout the book, the reader cannot fail to be impressed with the author's sincerity and with his boundless enthusiasm for his work. A most significant contribution to orthoptics is his emphasis of the fact that each patient must be individualized and orthoptic procedures adapted to the patient in question. His routines for the therapy of particular conditions are carefully generalized, but his case reports reveal much individualization in actual therapy.

After four introductory chapters on history, some visual physiology, and amblyopia, there follow chapters on corrective procedures, esophoria, exophoria, vertical anomalies, orthoptics in strabismus, concomitant esotropia, monolateral exotropia, alternating strabismus, compound muscle anomalies, anomalies of reading, pre-orthoptic care of the very young squinter, anomalies of accommodation, miscellaneous anomalies, paralytic squint, and orthoptic instruments. There is an appendix of case reports with treatment procedures. A glossary partially compensates for the fact that Smith uses many terms which apparently have different meanings for the optometrist and the ophthalmologist.

So mixed were my reactions to the book that I read it three times in its entirety. One wonders about such statements as "The treatment procedure by orthoptics is so simplified that a child of two years may benefit." While it is entirely possible that a two-year-old child might benefit from orthoptics, it is difficult to believe that many actually do so in any practical manner.

Smith seems to have a broad and even intimate acquaintance with both optometric and ophthalmologic literature on the subject of disturbances of ocular motility and yet his apparent practical application of several concepts leaves disturbing doubts. Several examples should clarify this point:

"Ocular fundus pathology may cause amblyopia ex anopsia if the area affected involves the macula." . . .

At one point in describing technique, Smith either contradicts himself or fails to express his ideas clearly. On one page he states that he begins each training session with the targets on the major amblyoscope set at the zero position, admitting that such a procedure may seem unorthodox. On the next page he advises setting the targets at the angle of deviation in order that ". . . direct stimulation of the maculo-foveal area may be accomplished." The statements appear contradictory and it is difficult to tell what he actually does.

While showing familiarity with the studies on myopia conducted at The Johns Hopkins University and at Washington University, Smith remarks in a case report that ". . . it is hoped that . . . the myopia would, in time, be eliminated entirely," and he was not referring to pseudomyopia.

In another section, after discussing Lancaster's work and ideas on condemning the concept of "weak" muscles, Smith then speaks of prisms used in the treatment of exophoria with "the apex toward the affected (weaker) muscle."

He writes that "hyperphoria and hypophoria, unless alternating, are confined either to one eye or to both, whereas esophoria and exophoria are in all instances binocular anomalies."

The average ophthalmologist, at least, will probably be critical of the ocular calisthenics advocated by Smith for the purpose of ". . . stimulating neurovascular innervation to affected ocular muscles." He adds that such calisthenics ". . . can be included in each treatment for as much as one-half of the period without causing deleterious results." One cannot argue with this statement. The calisthenics consist in carrying the eyes into the six cardinal directions of gaze and Smith believes that they ". . . are indicated in every type of ocular muscle debility," and that ". . . in heterophorias they . . . constitute the basis of the entire treatment."

Smith's ideas on retinal stimulation are interesting and will probably be novel to the average orthoptist. I am unable to comment upon them because of my lack of experience with Smith's technique of direct and con-

timued stimulation of the fovea of the amblyopic eye with a bright light to the point of burning and lacrimation.

The book is of definite interest to the ophthalmologist interested in orthoptics and to the experienced orthoptist. It cannot be recommended to students without a caution for Smith's enthusiasm and a warning about disappointment because their results may not be as good as his.

Richard G. Scobee.

Diseases of the Eye, Ear, Nose, and Throat. A textbook for nurses. By Albert P. Seltzer, M.D., with the technical assistance of Bernard C. Gettes, M.D. New York, McGraw-Hill, 1950. Clothbound, 347 pages. Price, $4.00.

In the field of nursing education there exists a real need for textbooks dealing with the various specialties in a concise yet adequate form. There is a tendency either to present the material on a too advanced and technical level or to oversimplify the subject, and it is extremely difficult to achieve the most desirable result. This new book on eye, ear, nose, and throat would seem to have been prepared not for the student nurse but for the graduate who is to be employed in a specialty clinic or in the office of a private practitioner. For this purpose it can be recommended but it is doubtful that it would make a completely satisfactory textbook for student nurses.

The author's personal interest in ear, nose, and throat is reflected in the emphasis and more adequate coverage of this material than is allotted ophthalmic conditions. About 122 pages are devoted to the eye approximately 50 percent more to ear, nose, and throat. The chapter on anatomy, embryology, and physiology of the eye is clearly and simply expressed and, although the material is presented in quite abbreviated form, it is possibly adequate for the purpose. In this chapter and that on examination of the eye, the author oversimplifies description.

Consideration of treatment and postoperative nursing procedures is naturally influenced by personal preferences. One is somewhat surprised to find frequent references to yellow oxide, argyrol, and leeches in such a recent book, although the antibiotics and newer forms of therapy are also mentioned. The inclusion of a list of "do's and don'ts" in eye nursing is good. In the back of the book is also a list of films suitable for showing to nursing groups.

William A. Mann.

Bulletin de la Société Belge d'Ophthalmologie. No. 92, June 19, 1949.

Coppez showed several cases of partial penetrating keratoplasty with films. Brutsaert and Danis present a case of a six-year-old boy with macular retinopathy due to toxoplasmosis. François, Kluyskens, and Philips present two cases of complicated coloboma of the iris, in one case atypical and unilateral, and in the other case typical and bilateral.

Michiels and Delfosso describe a case of central serous choroiditis and show a beautiful colored picture of the fundus. They treated the patient by rest, vitamins, calcium, antihistaminics, and vasodilators.

Weekers, Weekers, and Heintz give further evidence of their interest in the effect of nonperforating cyclodiathermy in the treatment of chronic glaucoma. Walsch gives histopathologic studies of a case of hypertensive uveitis treated by cyclodiathermy. The microscopic description is given in detail. De Jaeger and Bernolet describe a conjunctival flap and suturing of the wound which they use in the treatment of perforating injuries of the eye.

Van Lint and Alaerts tried the therapeutic effect of a five-percent urea solution followed shortly by sulfonamide drops. In acute and subacute conjunctivitis this treatment was inferior to the classical method of treatment. In chronic conjunctivitis the treatment worked very well. Urea apparently fa-

vors the penetration of the sulfa drug into the tissues.

Pirot describes a case of a traumatic compression of the optic nerve with abolition of the pupillary reflex to light. There was a partial optic atrophy, and the retention of the vision (hand movements) in the superior nasal quadrant. The fracture was in the right temporal region, and the left eye was normal. Later the vision of the affected eye increased to 5/10.

Zanen suggests that the rhythm of fluctuation for colors is perhaps due to a difference in retinal chromatic adaptation rather than cortical in origin.

Humblet presents a case of malignant exophthalmos secondary to thyroidism, which resulted in the loss and enucleation of the right eye. The loss of the left eye was barely prevented by tarsorrhaphy and orbital decompression through the temporal route.

Timmerman mentions the two main causes of exophthalmos—the physiologic—and the pathologic. Included in the former are fat, fullness of the orbital vessels, particularly venous stasis. Included in the latter are endocrine disturbances, inflammatory, neoplasms, and trauma. The average protrusion of an eye is 14.18 mm. Myopic eyes are more prominent, averaging 16.34 mm.; whereas, hypermetropic eyes vary from 13.5 to 15 mm.

Harbig presents the subject of ocular yaws, dividing it into two kinds—external and internal—mentioning that the literature has practically nothing concerning the internal kind. The external secondary type is a disease mostly of children between the ages of 4 and 16 years. The cutaneous form may be localized or generalized; the generalized appears in three types, roseola, macular, and papilloma. The papillomas have a predilection for the face and trunk. The orbitopalpebral type is found in adults. They may show a proliferating osteitis of the nose, and some have been reported with a bilateral and periorbital hyperostosis. The best therapy is neosalvarsan.

François, Kluyskens, and Rabaey describe a case of probable traumatic plasmocytoma of the orbit in a man, aged 77 years. There have been only a few cases of this neoplasm reported. François presents a prepapillary cyst in a girl, aged two-and-one-half years, which after six years showed neither modification of structure nor volume.

Mathieu describes and discusses basal anesthesia in adults and infants. Hoorens mentions a case of strabismus aided by surgery, orthoptics, and prisms, wherein the patient had shown a marked alternating strabismus of 35 degrees. Roussel discusses the technique and indication for free grafts in ophthalmology. He mentions pinch grafts, free grafts, and pedicle grafts. He likes the Padgett dermatome very much. Surgery is done under local anesthesia. When possible, a stent is used. Postoperatively they give penicillin, 300,000 units a day, for three days.

Alaerts presents a family in which there were five cases of megalocornea in eight persons. Megalocornea shows increased cornea diameter, deepening of the anterior chamber, and absence of corneal lesions. In differentiation from glaucoma there is normal ocular tension, bilaterality, normal functioning of the intraocular mechanism, and familial transmission.

Appelmans, Decock, and Van Opstal describe the treatment of a retinal angioma by diathermy coagulation. They consider it a very good method for cure. Zanen and De Laet present a case of scleromalacia perforans.

Bennett W. Muir.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

7

CONJUNCTIVA, CORNEA, SCLERA

Loewenstein, Arnold. **"Knob" at the periphery of Descemet's membrane.** Brit. J. Ophth. **34**:246-250, April, 1950.

The knob at the edge of Descemet's membrane is described and illustrated with photomicrographs. This swelling is present between the margin of Descemet's membrane and the corneo-scleral trabeculum. When aqueous enters the tissues this area may remain flat and form the white ring identical with the white ring of Schwalbe, or it may be swollen to form the prominent white ring seen with the high power slitlamp. It is granular and does not contain cells. The whitish ring seen by the slitlamp and the prominent knob may be identical. A cornea from an eye injured by mustard gas shows the corneal lamella in this area intensely swollen and dilated, and a large knob bigger than in other cases was present. This knob contained cloudy tissue without any nuclei. Orwyn H. Ellis.

Magni, S. **Reticulo-endothelial tumors of the conjunctiva.** Atti d. 37 Congresso Soc. ital. oftal. **10**:154-155, 1948.

The author describes three cases and believes that these tumors are more frequent than supposed. They are comparatively benign and are best treated by surgical excision followed by irradiation.

Frederick C. Blodi.

McGavic, J. S. **Surgical treatment of recurrent pterygium.** Arch. Ophth. **42**: 726-748, Dec., 1949.

An operative technique developed to eradicate severe recurrent pterygium is described. This procedure consists of lamellar keratectomy, submucous resection of all scar tissue and recession of the conjunctiva by suturing it to the sclera proper at least 5 mm. from the corneo-scleral junction. The denuded area of cornea and sclera is allowed to become epithelialized. Beta irradiation is used after operation when it is necessary to control vascularization. This technique has also been found suitable for excision of pseudoterygium and epibulbar tumors, repair of symblepharon and removal of superficially vascularized corneal scars. (8 figures, more than 7 pages of references.) John C. Long.

Miller, S. J. H., and Gordon, W. H. **White rings in the cornea.** Brit. J. Ophth. **34**:176-179, March, 1950.

A 66-year-old patient had sarcoma of the choroid of one eye and several tiny white rings within the substantia propria of the cornea of each eye. In an explosion some 30 years ago, both corneas were spattered with a gritty material. His eyes had been symptomless throughout the years. The eye bearing the sarcoma was removed and histologic studies made. The rings were found to be collections of foreign matter along with calcium deposits, and were in the very center of the cornea. Such rings have been described before when it was felt that they were evidence of intraocular disease. Morris Kaplan.

Oxilia, E., and Carlevaro, G. F. **A simple procedure for use in the repair of corneal wounds.** Ann. di ottal. e clin. ocul. **76**:29-37, Jan., 1950.

The disadvantages of corneal sutures, conjunctival flaps, and tarsorrhaphy can be avoided by using the inner layer of the membrane lining an eggshell for covering the cornea in the repair of penetrating corneal wounds. Although very thin, the inner layer is resistant enough to assure perfect closure of the wound when properly sutured in place. It is well tolerated, and its transparency permits continuous control of the eye during the postoperative course. If taken from a raw egg, as the author recommends, it can be sterilized by soaking for half an hour in a solution of penicillin. Reports of ten cases are given. It is suggested that egg membrane may also be used to prevent symblepharon in chemical or thermal burns of the eye. (References)

Harry K. Messenger.

Pagani. **Ocular symptoms in leptospirosis.** Atti d. 37 Congresso Soc. oftal. ital. **10**:215-220, 1948.

Marked hyperemia of the conjunctiva is an initial symptom in all types of leptospiroses. There is at the same time a photophobia, but no conjunctival secretion. Chronic uveitis is the most frequent and most important late complication.

Frederick C. Blodi.

La Rocca, V. **Keratectomy and conjunctival transplants in symblepharon.** Atti d. 37 Congresso Soc. ital. oftal. **10**: 142-143, 1948.

Bad results with homotransplants of conjunctiva in a case of severe symblepharon lead the author to recommend the transplantation of oral mucosa.

Frederick C. Blodi.

Roig. **Treatment of trachoma by electrocoagulation.** Arch. Soc. oftal. hispanoam. **10**:256-259, March, 1950.

After preliminary treatment with antibiotics for 3 or 4 days the author employs electrocoagulation of the surface of the lids under local anesthesia. He makes 5 or 6 lines of superficial electrocoagulation points, which are almost contiguous. He then makes a conjunctival incision through the entire transitional fold of the lid. In trachomatous pannus he makes instead of the incision an excision of a strip of conjunctiva. After 16 years in French Morocco, where trachoma is common, the author was convinced of the efficacy of this procedure. (1 figure.)

Ray K. Daily.

Stansbury, F. C. **Corneal transplantation. 1. Visual and cosmetic results.** Arch. Ophth. **42**:813-844, Dec., 1949.

Recent lay as well as professional articles have been misleadingly optimistic as to the visual results of corneal transplantation. The author points out various fallacies in the interpretation of published results. He reviews the records of all operations performed in the ward services at the Institute of Ophthalmology of the Columbia University-Presbyterian Hospital Medical Center between 1933 and 1947. After excluding 17 cases because the follow-up period was less than

six months, there remained 165 operations, performed on 110 patients. Transparency of the graft cannot be considered adequate proof of a successful operation, because clear grafts are frequently seen without any functional improvement in the eye. The best results were obtained in cases of keratoconus; 10 of the 22 successful operations occurred in the keratoconus group. Poorest results were obtained in cases with chemical burns of the cornea; none of these operations were successful. The final visual results on the basis of the 110 patients were as follows: improved vision, 16 percent; no significant change in vision, 42 percent; loss of vision, 39 percent, and unknown results, 3 percent.

John C. Long.

Stern, H. J. **Conditioned corneal vascularity in riboflavine deficiency.** Arch. Ophth. **42**:438-442, Oct., 1949.

A Greek war veteran, aged 38 years, was observed in a nearly blind condition, the result of extensive corneal opacities and vascularization. He had received a shell blast injury to his face and eyes in 1940 and had spent five years in Italian and German prison camps. During this time his eyesight deteriorated steadily. During the war years he had been on a diet seriously deficient in all members of the vitamin B complex, as well as in other vitamins. During all these years his diet was inadequate, and even now he consumed too little riboflavine. Dramatic improvement was observed promptly after the daily inclusion of 15 milligrams of riboflavine in his diet. The opacities receded considerably and the blood vessels became much less noticeable. There was marked improvement in visual acuity. Clinical investigation now under way seems to indicate that chronic riboflavine deficiency may produce corneal vascularization only if and when the cornea is exposed to trauma. In the case presented it is thought that the shell blast injury may have been a contributory factor.

John C. Long.

Thomas, C. I. **Corneal fistula following transplantation: report of two cases; methods of treatment.** Arch. Ophth. **43**: 503-508, March, 1950.

Fistulization of the transplant margin may occur if the corneal epithelium in its regeneration follows the edge of the wound down into the anterior chamber in the same manner as epithelium occasionally invades the anterior chamber after cataract extraction. Corneal fistula may be closed by the usual thermal or chemical cauterization, or by the method introduced and advocated by the author, which consists of transplantation of a mucous membrane graft to a previously curetted fistulous tract. E. J. Swets.

Toselli, Carlo. **Interstitial fracture of the cornea.** Rassegna ital. d'ottal. **19**:46-49, Jan.-Feb., 1950.

A 41-year-old joiner was struck in the right eye by a piece of wood. A laceration of the bulbar conjunctiva and the production of two fractures of Descemet's membrane in the form of the letter V resulted. The epithelium and Bowman's membrane were intact, the aqueous clear and the pupil dilated and inactive, the tension reduced. The vision was 8/10.

Eugene M. Blake.

Venco, L. **The so-called "diseases of the graft" in keratoplasty.** Atti d. 37 Congresso Soc. oftal. ital. **10**:347-350, 1948.

In this group can be included the early necrosis (within the first 10 days), and the late opacification of the graft. Interesting and more important is the opacification occurring during the third week.

Frederick C. Blodi.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Alvaro, M. E. **The part played by Roentgen rays in the treatment of uveitis.** Ophthalmologica **118**:469-482, Oct.-Nov., 1949.

Since the etiology of many cases of uveitis remains undetermined, the treatment should be directed primarily at the nonspecific features of the pathogenetic mechanism, which is neurovascular. The bacterial or other causative agent produces a vasoconstriction in the terminal (most distal) areas. Most of the measures that have been advocated for the treatment of uveitis cause local hyperemia and acceleration of blood circulation. Roentgen rays cause an immediate dilation of the capillaries. The author uses hard rays in individual doses of about 60 Roentgen units. The results were very favorable in 11 cases. Peter C. Kronfeld.

Blanchi, G. **Plastic uveitis in rheumatic purpura.** Atti d. 37 Congresso Soc. ital. oftal. **10**:63-64, 1948.

The usual ocular manifestations of Schoenlein-Henoch's disease are subconjunctival and retinal hemorrhages. The author reports for the first time three cases of rheumatic purpura associated with uveitis. Frederick S. Blodi.

Bonnet, Paul. **Rubeosis iridis.** Ophthalmologica **118**:575-588, Oct.-Nov., 1949.

The biomicroscopic and gonioscopic findings in 25 cases of rubeosis iridis are described in detail. In 22 cases the patients were diabetics, in the remaining three arteriosclerotics with obstruction of the central retinal vein and other vascular lesions. Rubeosis is an alarm signal, that is, an unfavorable prognostic sign because hemorrhagic glaucoma ensues almost invariably. Peter C. Kronfeld.

Bottoni, Angelo. **Synechias of the iridocorneal angle: gonioscopic observations.** Ann. di ottal. e clin. ocul. **76**:38-42, Jan., 1950.

Peripheral synechias are not a sign of any particular disease but are the result of reactive phenomena attending inflammation of the tissues that form the walls of the iridocorneal angle. They are certainly not the prime cause of ocular hypertension. Cases of complete annular synechia between the base of the iris and the scleral trabeculum are seen without the least increase in tension, and hypertension is seen in eyes in which the angle is entirely free from adhesions. Peripheral synechias are very frequent in uveitis. They occurred in 87 percent of Bottoni's cases. Three forms of synechias are described. These occur indifferently in any type of uveitis, but are more numerous in severe or long protracted cases. On the other hand synechias are commonly absent in glaucoma.

Harry K. Messenger.

Cattaneo, Donato. **Vascular changes in the choroid and their influence on the pathogenesis of ocular affections.** Ann. di ottal. e clin. ocul. **76**:3-28, Jan., 1950.

Vascular disturbances in the choroid are difficult or impossible to detect clinically in their early stages when they may be unaccompanied by any appreciable impairment of ocular function. As the choroidal vessels are normally invisible ophthalmoscopically as long as the pigment epithelium remains intact, it is not strange that the importance of vascular disease of the choroid has been overlooked. Many inflammatory, degenerative, and dystrophic processes in the retina, which are generally attributed to anatomic or metabolic changes in the retina itself, are really secondary to disease of the choroidal vessels. Usually it is only

when pathologic changes in the choroid have resulted in atrophy of the pigment epithelium that the diseased choroidal vessels are seen. Among the ocular functions consistently associated with vascular changes in the choroid are senile mascular chorioretinal degenerations, both senile and juvenile disciform degeneration of the macula, Fuch's circinate retinitis, Coats' disease, agioid streaks, gyrate atrophy of the choroid and retina, and retinosis pigmentosa. There is an interdependence between ocular hypertension and alterations in the choroidal circulation. The vessels of the choroid may show pathologic changes in diseases of the kidney and liver and in chronic infectious diseases such as syphilis and tuberculosis. (References.)

Harry K. Messenger.

Gonzales Pola, A. M. **Hypertensive uveitis.** Arch. Soc. oftal. hispano-am. **10**: 215-223, March, 1950.

Studies of vascular permeability by the fluorescein tests, controlled by biomicroscopic and gonioscopic observation, lead to the conclusion that the pathogenesis of hypertensive uveitis stems from an underlying vascular disturbance. The more acute the uveitis the more rapidly and in greater proportion does fluorescein appear in the anterior chamber; its elimination is equally rapid and the canal of Schlemm and the aqueous veins are quickly colored green. Because of the relative hypotony, blood is frequently found in the canal of Schlemm. The occurrence of a hypertension changes the picture of the fluorescein test in the aqueous; if the rise in tension appears in the acute stage of uveitis, which is a rare occurrence, the appearance of fluorescein is still rapid but its elimination is delayed; it improves as the tension falls. In a hypertension in a chronic uveitis the appearance of fluorescein is retarded and the elimination greatly impeded; the more the elimination is interfered with, the poorer is the prognosis. The increased uveal permeability which follows the administration of a vaso-dilator or the use of protein therapy is compensated by an acceleration of drainage. Interference with drainage results in venous stasis which forms the basis of hypertension. Graphic studies of the fluorescein test as a criterion of the vascular permeability demonstrate the importance of the uveal circulation in the production and cure of hypertension complicating uveitis. (6 graphs.)

Ray K. Daily.

Monciino, Nicolò. **A case of bilateral coloboma of the macular region associated with paralysis of the abducens.** Ann. di ottal. e clin. ocul. **76**:66-73, Feb., 1950.

Monciino reports a case of bilateral coloboma of the mascular region in association with bilateral abducens paralysis, the twenty-sixth case of bilateral coloboma reported in the literature. The association of congenital colobomas of the choroid and retina and of the optic nerve with bilateral abducens paralysis has been previously noted. Monciino thinks that the cause of this malformation should be sought in an intra-uterine toxic inflammatory process. The clinical characteristics of chorioretinal colobomas and the theories regarding their etiology are briefly reviewed, and their differential diagnosis is discussed. (References)

Harry K. Messenger.

Müller, Horst. **The histologic picture of allergic choroiditis in the presence of allergic nephritis.** Arch. f. Ophth. **150**:58-74, 1950.

Eight eyes were studied. Nodules and granulomas within the choroid combine with all stages of allergic vascular changes such as subendothelial ring-shaped hemorrhages, proliferation of the intima, mucoid swelling of the media and swelling and proliferation of the adven-

titia. These phenomena together with general signs of an allergic response of the body are considered an allergic choroiditis. Ernst Schmerl.

Müller, Horst. **Malignant choroid tumor simulating fulminating exudative choroiditis with questionable tumor-rheumatoid.** Klin. Monatsbl. f. Augenh. 116:53-61, 1950.

Retinal detachment without a tear was noted in a 19-year-old girl who suffered from a chronic rheumatic infection, acute endocarditis and myocarditis. Transillumination of the eyeball showed no shadow. The patient was treated for exudative choroiditis with salicylates. The detachment increased until it filled the whole eyeball, but still no shadow was detected on transillumination. After scleritis, protrusion of the eyeball, and secondary glaucoma had developed, the eye was enucleated. Pathologic examination revealed that the choroid was evenly thickened to twice its original size and had many necrotic areas. A diagnosis of malignant choroid tumor of ectodermal origin, melanocytoblastoma of the choroid, was made. Tumor cells left the eyeball along the emissary veins and an extrabulbar metastatic tumor formed on the sclera. Two months later the patient fractured her leg. A sarcoma, obviously metastatic, developed in the scar tissue. Soon thereafter the patient died. The author raises the question whether the rheumatoid infection, fever and arthritis were the expression of sensitization to necrotic tumor material. R. Grunfeld.

Redslob, Edmond. **Old and new thoughts on the pathogeneais of sympathetic ophthalmia.** Ophthalmologica 118: 483-495, Oct.-Nov., 1949.

E. Fuchs's classical description of the pathology of sympathetic ophthalmia defines the disease so well that in most cases a definite pathologic diagnosis can be made. Occasionally the author has found it difficult to distinguish between septic endophthalmitis and sympathetic ophthalmia. He attaches great significance to the findings at the portal of entry, that is, at the place of perforation. From there, in his opinion, a state of bacteremia is propagated which in turn gives rise to the inflammation of the second eye. The characteristic infiltrations in sympathetic ophthalmia are due to microbes and not to toxins. With improved techniques the causative organism will be identified. Peter C. Kronfeld.

de Saint Martin, R. **Tissue therapy and sympathetic ophthalmia.** Atti d. 37 Congresso Soc. ital. oftal. 10:113-115, 1948.

The author had remarkably good results in two cases of sympathetic ophthalmia by the injection of placental extracts. Frederick C. Blodi.

Straub, Wolfgang. **Metastatic choroid carcinoma in a man with carcinoma of the breast.** Klin. Monatsbl. f. Augenh. 116:61-65, 1950.

In a 68-year-old patient metastatic carcinoma of the choroid was observed 18 months after extirpation of a carcinoma of the breast. The eyes were not enucleated but the fundus findings were typical. Six weeks later the retina above the papilla became detached. In the right eye a cataract was removed at the patient's urgent request and it was found that the whole lower half of the retina was detached. The patient died four months later. R. Grunfeld.

Verrey, Florian. **Acute anterior uveitis due to staphylococcus aureus.** Ophthalmologica 118:461-468, Oct.-Nov., 1949.

In a case of acute anterior uveitis in a 31-year-old woman an etiologic diagnosis was made on the basis of the following findings. 1. A positive culture was obtained on Rosenow bouillon from aqueous

withdrawn on the fourth day of the disease. 2. In a smear from aqueous withdrawn on the ninth day of the disease intracellular and agglutinated extracellular cocci could be identified. 3. The patient proved extremely sensitive to an autogenous vaccine. 4. Vaccine therapy resulted in gradual desensitization and subsidence of the uveitis. The author stresses the diagnostic value of anterior chamber punctures.

Peter C. Kronfeld.

9

GLAUCOMA AND OCULAR TENSION

Arruga, H. **Cyclodiathermy in the treatment of glaucoma.** Arch. Soc. oftal. hispano-am. **10**:224-229, March, 1950.

Arruga uses the Lacarrere electrode, with a needle 1 mm. long. An intensity of 15 to 30 milliamperes is applied for 5 to 10 seconds to 15 to 20 points 9 mm. from the limbus. The tendons of the recti muscles along which the long posterior ciliary arteries course are avoided. Occasional perforations of the sclera, which may occur if the sclera is thin, caused no complications. Arruga found the results satisfactory in simple chronic, chronic inflammatory, and absolute glaucoma. (2 figures.) Ray K. Daily.

Bick, M. W. **Use of tantalum for ocular drainage.** Arch. Ophth. **42**:373-388, Oct., 1949.

Experimental implantation of tantalum within the eye indicated that this metal was well tolerated by the cornea, iris, ciliary body and sclera. Endothelium-lined fistulas formed around tantalum plates inserted into the clefts after cyclodialysis. Tantalum plates were inserted into four human eyes with glaucoma after cyclodialysis. The tension was controlled for only two weeks. At the time of this report a tantalum plate had remained in an eye with absolute glaucoma for a year and a half. The tension was about 40 mm. Hg (Schiøtz). A small pannus had formed in the vicinity of the implant, but the eye remained white and the media clear. Work on rabbits indicates that drainage of aqueous in the normal eye can be maintained by implanting a tantalum tube in the suprachoroidal space to extend from the chamber angle to the episcleral tissues. Some local reaction results, probably from mechanical injury by the unyielding, rigid foreign body. Further experimentation with similar devices should be rewarding if a more flexible material capable of maintaining a lumen were used. John C. Long.

Bietti, Giambattista. **Surgical intervention on the ciliary body.** J.A.M.A. **142**:889-897, March 25, 1950.

A historical review of surgical intervention on the ciliary body for the relief of ocular hypertension, and the more recent methods in this field are discussed. Particular attention is paid to two types of procedure: 1. the methods acting superficially on the ciliary body such as non-perforating diathermy on the bared sclera (Albaugh and Dunphy) or over the conjunctiva (L. and R. Weekers), subscleral diathermic coagulation of the ciliary body (Thiel), and solid carbon dioxide cauterizations (Bietti) and 2. to the technique the aim of which is the reduction of the blood supply to the ciliary body such as diathermocoagulation of the long posterior ciliary arteries (Guerry); cycloanemization with diathermy (Kettesy); diathermocoagulation of the anterior ciliary arteries (Albrich and Baurmann), and cilioanolysis (electrolytic anodic subscleral coagulation of the long ciliary arteries) and cycloanolysis (electrolytic anodic cylodialysis) according to Schreck.

The results and the mode of action of these methods, several of them personally and repeatedly tested by the author, are reported and discussed. The superficially

acting methods are less dangerous than the perforating methods but are also less effective, since their action is sometimes only temporary. They are particularly advisable when a transient lowering of the ocular tension is required, as in hypertensive uveitis or in hypertension following keratoplasty. Because of their harmlessness, and because of the possibility of an almost indefinite repetition, these superficially acting methods should be tried in every case of glaucoma in which the common methods have been, or are expected to be ineffective. In case of failure to control definitively the ocular tension, a more severe operation (Vogt's perforating cyclodiathermy or electrolysis) can later be easily performed. In absolute glaucoma, even though the tension is not completely controlled at times, these operations usually eliminate the pain. Theodore M. Shapira.

Biozzi, Giuseppe. **Coagulation of the long ciliary artery.** Giorn. ital. oftal. **2**:380-383, Sept.-Oct., 1949.

It was possible to see the thrombosed artery ophthalmoscopically after diathermy coagulation of the long posterior ciliary artery in glaucoma. The same ophthalmoscopic picture was found postoperatively in a case of retinal detachment in which diathermy coagulation had been performed on the horizontal meridian. Vito La Rocca.

Brand, I. **Action of Filatov's placental extract upon the intraocular pressure.** Szemészet **1**:26-35, 1950.

Patients with normal tension, hypotonia, simple and congestive glaucoma, and inflammed eyes were given 2 cc. of the solution intravenously or hypodermically and 0.3 cc. subconjunctivally, and the ocular tension was measured at intervals. Filatov's tissue therapy results in changes of the ocular tension. These changes have no particular sequel in eyes with normal tension. In glaucoma, subconjunctival injection seems undesirable and in simple glaucoma even intravenous application of the extract may result in an elevation of the intraocular pressure. On the other hand, in congestive and secondary glaucoma occurring in inflammed eyes the administration of Filatov's extract has a favorable effect, provided that the usual therapy is not omitted. Gyula Lugossy.

Campos, R. **Combined glaucoma operations: cyclodialysis with basal iridectomy.** Atti d. 37 Congresso Soc. oftal. ital. **10**: 368-371, 1948.

The basal iridectomy is done through a separate scleral incision and after the cyclodialysis has been started but before its completion. Frederick C. Blodi.

Carreras Duran, Buenaventura. **Combined operations in glaucoma.** Arch. Soc. oftal. hispano-am. **10**:230-248, March, 1950.

To avoid repeated operations, Carreras advocates a combination of several antiglaucomatous procedures at the first surgical intervention in advanced glaucoma. Iridectomy with two cyclodialyses, one in each upper scleral quadrant, is the combination employed for acute or subacute unresolved glaucoma. A single cyclodialysis inversa between the insertion of the superior rectus and the limbus is substituted at times for the double opening into the iridocorneal angle. In cases of long duration and consistently high tension a Vogt cyclodiathermy with a ½-mm. needle is substituted for the cyclodialysis. In cases of very high tension he adds to the shallow punctures 3 to 4 perforations with a 2-mm. needle, which afford some escape of vitreous and soften the eyeball. In chronic congestive glaucoma, the effect of an Elliott trepanation is increased by enlarging the trephine opening with scissors and perform-

ing a typical glaucoma iridectomy. In simple glaucoma the Elliott trepanation is combined with a Vogt cyclodiathermy. (8 figures) Ray K. Daily.

Dunnington, J. H., and Regan, E. F. **Late fistulization of operative wounds: diagnosis and treatment.** Arch. Ophth. **43**:407-418, March, 1950.

The authors describe postoperative hypotony with late fistula formation and point out that it has received relatively little attention. The fistula may be constantly open, or it may be closed at times. Commonly the condition occurs some months or weeks after uneventful intraocular surgery, and the patient presents himself with tearing, intermittent blurring of vision, and a dull ache about the eye. The eye may appear normal to casual inspection. Hypotony, ciliary tenderness, and a cystoid area of conjunctiva may be present. Certain diagnosis of slow leakage is provided by the fluorescein test. Cauterization of the wound margin, direct suturing of the corneoscleral fistula, and covering the wound with a Van Lint flap was successful in 13 of the 15 cases.

E. J. Swets.

Jeandelize, P. **Hypopituitarism in five cases of juvenile glaucoma.** Ophthalmologica **118**:548-554, Oct.-Nov., 1949.

In five cases of juvenile glaucoma the presence of hypopituitarism was suggested by a high glucose tolerance, a slightly elevated cholesterol content of the blood and a slightly low basal metabolic rate. Daily injections of posterior lobe extract normalized the ocular tension after pilocarpine and eserine had become ineffective. Peter C. Kronfeld.

Matteucci, Pellegrino. **Glaucoma of the arterial hypotensive.** Ann. d'ocul. **183**:313-325, April, 1950.

Hypotensive glaucoma is primarily a constitutional, bilateral, progressive, mesodermal, degenerative disease. A vascular degeneration in the region of the lamina cribrosa is apparently primary and is part of a bodily vascular degeneration which also frequently involves the brain, especially the diencephalic area. In the early stages the pupils are approximately of normal size and the light reactions more or less diminished. During the later stages focal or general iris atrophy is frequent. Disc pallor and an overhanging excavation with vascular displacement usually begins early in the disease. Ocular tension is normal or subnormal. Changes in the central and peripheral fields are quite similar to those observed in the hypertonic form of glaucoma. In contrast to the hypertonic form, however, the hypotensive form is characterized by intolerance to parasympathetico-mimetic drugs, both of the acetylcholine and esterase types. The author reports six cases in five of which there were definite evidences of diencephalic dysfunction. Sudden decrease of arterial vascular tension is frequently followed by aggravation of the ocular symptoms. In the hypotensive type of glaucoma, miotic and surgical treatment are less efficient than in the hypertensive form. Hormonal therapy is considered worthy of further experimental use. Chas. A. Bahn.

Persichetti, C. **The intraocular pressure during local anesthesia.** Atti d. 37 Congresso Soc. oftal. ital. **10**:234-266, 1948.

Hypotony is the rule after a retrobulbar injection of novocain with or without adrenaline. This hypotony reaches its peak 10 to 20 minutes after the injection and may be preceded by a shortlasting hypertony. Retrobulbar injection of adrenaline alone has no influence on the intraocular pressure. The topical application of 10 percent cocaine also decreases the intraocular pressure. The effect is

enhanced by a retrobulbar novocain injection. (References)

Frederick C. Blodi.

Puglisi-Duranti, G. **Central serous choroiditis.** Atti. d. 37 Congresso Soc. oftal. ital. **10**:279-283, 1948.

This condition is discussed in connection with a case. The author believes that the primary lesion is in the choroid. Only this could explain the relatively good central vision and the atrophic choroiditic area which may develop after years.

Frederick C. Blodi.

Redslob, E. **The development of the "solder" of Knies in glaucoma.** Ann. d'ocul. **183**:297-312, April, 1950.

The "solder" of Knies as expressed in French is more expressive than our English equivalent, "junction." Both mean the peripheral adhesion of the anterior iris to the posterior cornea in what is usually termed "narrow-angled glaucoma." The author studied the eyes of guillotined persons within one half hour after death because sudden death occurred with the head in a horizontal position. This favored a better understanding of the size and shape of the normal anterior chamber angle. The author is convinced that corneo-iris peripheral adhesions in primary glaucoma are always secondary to vascular disease and do not depend basically upon the shallowness of the anterior chamber. Ten sections are presented to illustrate the several stages involved in the evolution of these adhesions.

Chas. A. Bahn.

Ross, Reinulv. **A case of acute congestive glaucoma with exfoliation of the lens capsule.** Acta ophth. **27**:475-482, 1949.

The author reports a case of acute congestive glaucoma, in which after operation and recovery it was found that the patient had exfoliation of the lens capsule, and the white subcapsular spots on the lens reported by Vogt. This presented a problem in differential diagnosis. Was this an acute attack superimposed on a chronic glaucoma, or was this an acute glaucoma with incidental exfoliation of the lens capsule? The literature on exfoliation of the lens capsule is reviewed. It is concluded that its presence predisposes to glaucoma and that this case represents an acute attack in an eye predisposed to glaucoma.

Ray K. Daily.

Thomassen, T. L., and Leydhecker, W. **The lability test.** Brit. J. Ophth. **34**:169-175, March, 1950.

The lability test, which was first described in 1945, is a provocative test for glaucoma in eyes with normal pressure. It consists of putting one hand in ice-cold water and at the same time applying constriction to the neck in order to increase venous pressure in the head. In these studies on 52 normal persons and 15 glaucomatous patients the two parts of the test were done separately and together, and in addition the aqueous veins were carefully measured. Of the normal patients, 13 were subjected to the ice-water test alone which brought about no changes whatever. The cuff test alone produced changes in all 13 and the changes were almost identical with those brought about by the complete test. The full lability test produced an increase in tension of 0 to 8 mm. Hg with an average of 2.7 mm. in the 52 normal persons. Age had no influence on this rise which must be due entirely to increased blood volume within the eye.

In simple glaucoma, when the eye is in the phase of increasing tension, the lability test will be positive, and when in the decreasing phase, it will be negative. The absolute height of the pressure or the use of pilocarpine has no effect on the test.

Morris Kaplan.

Thomassen, T. L., Perkins, E. S., and Dobree, J. H. **Aqueous veins in glaucomatous eyes.** Brit. J. Ophth. **34**:221-227, April, 1950.

The object of this paper is to present photographs of aqueous veins. It is found that in some eyes suffering from glaucoma little or no clear fluid is present in the aqueous veins when the ocular tension is in an increasing phase; however, there is increased outflow of clear fluid when the tension is in a decreasing phase. As a complication to these observations it was found that the light from the slitlamp beam in some cases definitely increased the amount of blood in the aqueous veins. A large number of patients were examined and the results, which were found to be more or less equivocal, were recorded. There are three possible explanations of the close relationship of the aqueous veins and the changes in the tension. It may be that the venous pressure in the globe is high when the bulbar tension is increasing, and low when it is decreasing. Thus, it would be easy to understand that the aqueous would be displaced by blood. The outflow of aqueous would, therefore, be hampered, causing the tension to increase. It has been found that the pressure in the aqueous veins is decreased in glaucomatous eyes and this is explained by the findings in this paper. The third possible explanation is that there is no positive relationship between the phenomena whatever and it may be that the increase of blood in the aqueous veins is a vascular phenomenon, similar to hyperemia, caused either by the irritation of the pontocaine or the tonometer. It was shown that pilocarpine can increase the outflow of aqueous, but only when it produces a decreasing phase in the tension.

Orwyn H. Ellis.

Weekers, R., Roussel, F., and Heintz, A. **The critical fusion frequency in glaucoma.** Ophthalmologica **118**:555-563, Oct.-Nov., 1949.

In previous publications the authors have described their method of flicker perimetry, that is, of quantitative light sense tests in 26 representative points of the visual field. In early cases of glaucoma this method may prove more sensitive than ordinary campimetry with small or low-intensity targets.

Peter C. Kronfeld.

10

CRYSTALLINE LENS

Katavisto, Martii. **Prurigo diathesique Besnier and cataract.** Acta ophth. **27**:581-589, 1949.

The material on atopic dermatitis and cataract treated during the years 1934-48 at the dermatological department of the General Hospital at Helsinki is reviewed. Of 167 dermatological patients 58 were available for ophthalmologic examination. Lenticular opacities were found in 12 of these; their histories are presented briefly. The histories of five other patients with cataract and atopic dermatitis are also reported. The skin lesion is considered a hypersensitivity reaction, resulting from a constitutional predisposition; participation of the lens capsule, which originates from ectoderm, in this process results in a lenticular opacity.

Ray K. Daily.

Marner, Else. **A family with eight generations of hereditary cataract.** Acta ophth. **27**:538-551, 1949.

The eight generations with zonular cataract are tabulated relative to heredity, morphology, anticipation, myopia, strabismus, nystagmus, treatment, age of operation, surgical results, operative complications, social consequences, and the eugenic measures applied.

Ray K. Daily.

Meyer, S. J., and Sternberg, P. **Secondary glaucoma after cataract extraction.** Tr. Am. Acad. Ophth. pp. 326-340, March-April, 1950.

The authors analyze a series of 54 cases of glaucoma secondary to cataract extraction in which conjunctival sutures were used, and a later series of 150 extractions in which the wound was closed with corneo-scleral sutures. Operative and immediate post-operative complications such as vitreous loss, hyphema and delayed reformation of the anterior chamber were correlated with the incidence of aphakic glaucoma. Delayed reformation of the anterior chamber occurred most often when a conjunctival suture was used, and secondary glaucoma followed the development of anterior synchiae. Postoperative iridocyclitis and vitreous loss occurred most frequently when the plus-minus method of lens extraction was employed. Iridocylitis was occasionally attributable to the presence of suture material, particularly when the McLean type of closure was employed. The authors recommend early suture removal. Gustav C. Bahn.

Nordmann, Jean. **Sclerosis of the crystalline lens.** Ophthalmologica **118**: 369-377, Oct.-Nov., 1949.

The literature concerning senile hardening of the lens is reviewed. The author is especially interested in the source of the insoluble proteins which accumulate in the aging lens. According to his own experimental findings it is the beta-crystalline, the solubility of which gradually decreases, that causes accumulation of insoluble proteins.
Peter C. Kronfeld.

Pagliarani, N. **Hyphema after cataract extraction.** Atti d. 37 Congresso Soc. oftal. ital. **10**:221-233, 1948.

The author gives a good survey of the whole problem and analyses the cases of the last two years seen at the Eye Clinic in Bologna. Hypema occurred in 50 out of 336 operations. The administration of vitamin C and K seemed to have a favorable effect. Frederick C. Blodi.

Pincus, M. H. **Epithelial invasion of anterior chamber following cataract extraction: effect of radiation therapy.** Arch. Ophth. **43**:509-519, March, 1950.

Five cases of epithelial invasion of the anterior chamber after cataract extraction are reported. It occurs in 0.06 to 0.11 per cent of all cataract extractions and is a most malignant postoperative complication. Delayed formation of the anterior chamber and poor healing of the wound edges predisposes to its development. Untreated, this complication results in loss of the eye through severe iridocyclitis and glaucoma. Roentgen therapy or the radon plaque offer the best method of treatment. This type of therapy was employed in four of the five cases reported. Retardation of the downgrowth was noted in two cases, definite recession took place in one and no improvement was noted in the other. E. J. Swets.

Rosen, Emanuel. **Embryonal cataract associated with interstitial keratitis and syphilitic choroiditis.** Arch. Ophth. **42**:749-754, Dec., 1949.

Bilateral embryonal cataracts are reported in a congenital syphilitic. The condition was associated with interstitial keratitis, *glasleisten* and annual chorioretinitis. The location of the opacities within specific zones of the lens is indicative of nutritive disturbance of the lens at a period of syphilitic recrudescence. (2 figures.) John C. Long.

11
RETINA AND VITREOUS

Auricchio, G., and De Vincentiis, M. **Pigmentary degeneration of the retina**

caused by sodium iodide. Giorn. ital. oftal. **3**:118-127, March-April, 1950.

Experiments with rabbits failed to show a toxic effect on the retina, except in very strong doses, therefore it was concluded that sodium iodide affects the neuroepithelium by modifying the metabolism of some other tissues. Vito La Rocca.

Ballantyne, A. J. **New formed vessels in the fundus oculi.** Ophthalmologica **118**: 611-631, Oct.-Nov., 1949.

The author's previous original contributions to the subject of new-formed vessels in the fundus (Arch. Ophth. 33:97, 1945) are well known to the American reader. In the paper under review the various forms of such new-formed vessels are surveyed from the standpoint of pathogenesis. Most of these vessels are truly new-formed, arising by budding from the retinal and choroidal systems. To explain the fact that these blood vessels overcome obstacles such as Bruch's membrane, it is assumed that the parent vessel reverts to the embryonic type of growth, that is to endothelial budding followed by the formation of a supporting matrix of a primitive type of transparent, almost acellular connective tissue. It seems justifiable to assume that this new growth exercises a lytic power by which it overcomes the physical obstruction of the tissues and membranes. The new-formed vessels function as collateral channels to side-track an obstruction or as auxiliary nutritional channels. In the great majority, the new-formed vessels have their origin in the veins, and indeed are associated with thrombosis or some other cause of venous obstruction, in some the source is in the arteries, and in others they are based on an arteriovenous anastomosis. The author's associate, A. Lowenstein, is engaged in a study of new-formed intramural vessels, that is, new-formed vasa vasorum.

Peter C. Kronfeld.

De Bernardinis, Elio. **The relationship between longstanding idiopathic detachment of the retina and the glucose content of the subretinal fluid.** Rassegna ital. d'ottal. **19**:77-87, March-April, 1950.

Von Nordheim proposed a quotient for the relationship between the glucose in the subretinal fluid, glycemia, and the duration of the detachment. De Bernardinis reports upon 49 cases studied with these factors in mind and noted that the quotient was always above 1 in cases of old retinal detachment, below 1 in recent detachment, and independent of the results of the operative procedure. The author agrees with Weve and Fischer as to the cause of the variations in percentage of glucose, that is, the modification of the metabolism of the detached retina. He holds that that quotient can constitute a prognostic criterion. For a short time the detached retina maintains a normal metabolism, probably nourished by the glucose in the subretinal fluid. Later, pathologic oxidation occurs with less favorable operative results. (2 tables) Eugene M. Blake.

Brueckner, R., Bloch, W., and Wolff-Wiesinger, L. **Intermeningeal and retinal hemorrhages due to acute elevation of intracranial pressure.** Ophthalmologica **118**:607-610, Oct.-Nov., 1949.

The authors introduce a new or heretofore not thought-of factor to explain the hemorrhages that occur into the retina, the optic nerve and its sheaths during acute rises of the intracranial pressure. The arterial blood that enters the skull through the carotid artery encounters an unusual resistance in all intracranial arteries. Because of its short intracranial course the resistance in the ophthalmic arteries is somewhat lower. An unusually large amount of blood is thus forced into the ophthalmic arteries which leads to arterial plethora plus venous stasis in the structures in which the hemorrhages due

to increased intracranial pressure typically occur. The authors hope to be able to support this theory with pathologic and experimental evidence.

Peter C. Kronfeld.

Cardello, Giovanni. **Capillargy fragility in diabetic retinosis.** Rassegna ital. d'ottal. **19**:35-45, Jan.-Feb., 1950.

Twenty-seven patients with diabetes were studied to determine the relationship of the hyperglycemia, systemic hypertension, and the number of petechiae after five minutes of pressure of 150 mm. on a circumscribed area of the arm. Seventeen patients presented positive findings, 10 negative. Among the positive cases, only 4 showed retinosis and 1 hypertension, while among the negative, 3 were hypertensive and 3 had retinosis. Three of the patients with retinosis had no hypertension. All patients in whom petechiae appeared had retinosis and hypertension.

Eugene M. Blake.

Casari, G. F. **The fundus oculi in tumors of the suprarenal medulla.** Rassegna ital. d'ottal. **19**:50-63, Jan.-Feb., 1950.

A 26-year-old housewife suffered a severe nervous shock followed by hyperthyroidism, and later pregnancy. Blood pressure rose to 230 mm. Hg. Ophthalmoscopic examination showed a grayish elevation of the papilla of 2 diopters. Small hemorrhages were seen about the disc and the arterioles were reduced in caliber and their course altered. The veins were distended and there was edema of the surrounding retina. A falciform white patch was present in the macula. The changes were almost identical in the two eyes. A suprarenal neoplasm was suspected and confirmed by laboratory tests and, later, surgical intervention. Histologic study demonstrated a phytocytoma. A review of the literature shows that there is no retinal picture which is typical of this tumor, reports varying from a normal fundus to extreme grades of neuroretinopathy without consistent characteristics. Eugene M. Blake.

Cattaneo, D. **The chances of a functional recovery for patients with an old retinal detachment.** Atti d. 37 Congresso Soc. ital. oftal. **10**:74-87, 1948.

Two cases of retinal detachment are reported; one of two years' and one of one year's duration. Both eyes were operated on and had good functional results. Histologic examination of an eye enucleated seven months after the onset of a detachment showed the retina in good shape with the exception of the rods and cones. It can be assumed that the carbohydrates in the subretinal fluid may, for some time at least, provide enough nutrition for the retina to make a functional recovery possible. (References.)

Frederick C. Blodi.

Feigenbaum, Aryeh. **Xanthosis of the fundus in diabetes.** Ophthalmologica **118**: 632-636, Oct.-Nov., 1949.

In a consecutive series of 68 hospitalized diabetics the typical retinopathy was present in 48. In 17 of them the author discovered a peculiar yellowish tinge of the posterior pole of the fundus including the optic disc. This xanthosis was best seen by indirect ophthalmoscopy with Weve's 500-Watt fundus lamp. Within this yellowish area the retinal vessels appeared in strikingly sharp outline which the author explains as a contrast phenomenon. The yellowish discoloration is probably analogous to the xanthochromia of skin and bones frequently observed in diabetes. Peter C. Kronfeld.

Foroni, C. **Mechanical treatment of retinitis pigmentosa and retinal detachment.** Atti d. 37 Congresso Soc. ital oftal. **10**:123-132, 1948.

The author recommends his special massage of the conjunctiva ("massoressi")

for patients with retinitis pigmentosa and special cases of retinal detachment. He believes that such massage causes numerous conjunctival hemorrhages which destroy the noxious agents which infiltrate the conjunctiva. Frederick C. Blodi.

Gerber, Hans. **Angiospastic neuroretinitis with retinal detachment.** Ophthalmologica **118**:645-650, Oct.-Nov., 1949.

A man with malignant hypertension and nephrosclerosis died of apoplexy at the age of 40. Close ophthalmologic observation during the last two months of life revealed a severe bilateral neuroretinitis with retinal detachment which disappeared almost entirely during a temporary improvement in the patient's general condition. The clinical and autopsy findings are reported. Peter C. Kronfeld.

Hegner, H. **Relations between retinitis pigmentosa and the endocrine glands.** Ophthalmologica **118**:637-644, Oct.-Nov., 1949.

In a girl, 18 years of age, transient narrowing of the visual fields occurred with menstruation. These observations may serve as an explanation of the beneficial effect of follicular hormone reported by Wibaut (Internat. Ophthalm. Congress, Cairo, 1938) and K. Meyer (Graefe's Arch. 144:227, 1941). Peter C. Kronfeld.

Holm, Ejler. **Retinopathia praematurorum (retinal fibroplasia).** Acta ophth. **27**:623-631, 1949.

Holm reviews the literature on fibroplasia and reports graphically the development of what he believes is the first case in Europe. The child weighed 1,100 gm. at birth. At the first ophthalmologic examination, made when the child was three months old, opaque exudative cloudiness in the vitreous extending to the lens temporally, and a grayish white retinal detachment peripherally and nasally were found in the right eye. The vitreous of the left eye was clear, but peripheral grayish blue detachments were seen up and nasally. Within two months the detachments fused forming funnel-shaped detachments without retinal folds. The various opacities persisted for some time within the retinal funnel in the right eye, and left some horizontal strands in the left eye. This eye also developed increased tension. (10 fundus drawings)

Ray K. Daily.

di Luca, G. **Retinal periphlebitis and Buerger's disease.** Atti d. 37 Congresso Soc. ital. oftal. **10**:122, 1948.

The author rejects Marchesani's theory that retinal periphlebitis is the ocular manifestation of Buerger's disease. In his cases of retinal periphlebitis no signs of Buerger's disease could be found. In patients with Buerger's disease only the retinal arteries show some changes (endarteritis and sclerosis). Furthermore, he points out that a higher percentage of females are affected with retinal periphlebitis than with Buerger's disease and that Buerger's disease occurs in an older age group. Frederick C. Blodi.

Nastri, F. **Seasonal incidence of retinal detachment.** Atti d. 37 Congresso Soc. ital. oftal. **10**:192-196, 1948.

Analyzing the incidence of retinal detachment at the University Hospital in Rome the author finds a significantly increased incidence during the hot summer months similar to the findings of Weekers in Belgium. Frederick C. Blodi.

Nigro, L., and Ferri, E. **The peripheral and medullary blood count in Eales' disease.** Atti d. 37 Congresso Soc. ital. oftal. **10**:200-208, 1948.

In ten cases studied there was usually a slight anemia of the secondary type in the peripheral blood. The medullary puncture showed an increase in histiocytes and

a shift toward the left in the maturation of the myeloblasts. This was thought to be compatible with a tuberculous etiology of the disease. Frederick C. Blodi.

Pagliarani, N. **The treatment of thrombosis of the retinal veins with anticoagulants.** Giorn. ital. oftal. **2**:335-349, Sept.-Oct., 1949.

The author reports his experience in 16 cases. There was a noteworthy improvement in 10 patients, 8 of whom had been given cumarin and 2 heparine. There was a temporary hematuria in one.

Vito La Rocca.

Pillat, A. **Senile pigmentary degeneration of the retina.** Arch. f. Ophth. **150**:1-27, 1950.

Eight cases of senile degeneration and its differentiation from congenital retinitis pigmentosa are described. In retinitis pigmentosa the pigment appears in the shape of bone corpuscles spread over large areas of the fundus in all the layers of the retina. The retinal vessels are narrow, the papilla shows yellowish-white discoloration. A posterior cataract occurs almost regularly. The vision decreases progressively. The visual field and the light sense are markedly affected. In senile pigmentary degeneration the pigment appears grayish black diffusely spread and occurs almost only in the outer layers of the retina. Blood vessels, papilla and lens are normal. Central vision is good, the peripheral field shows ring-scotomas, the light sense is not markedly affected. Other changes due to old age may be present.

Ernst Schmerl.

Pines, N. **A clinical study of diabetic retinal angiopathy.** Brit. J. Ophth. **34**:303-317, May, 1950.

For studies of the possible mechanism of development of retinal angiopathy in diabetes, 5 normal controls, 5 with mild hypertension (diastolic pressure 90 to 100), 5 with advanced essential hypertension (diastolic pressure 100 to 150), and 40 diabetics of whom 14 had angiopathy were used. Blood pressure readings, the mean blood pressure and the oscillometer index of all extremities were taken on all subjects. The retinopathy is unmistakably connected with mild hypertension and advanced angiospasm of the lower extremities. In diabetic arteries the changes are chiefly a preponderance of cholesterine and calcium; Hyperglycemia injuries the endothelium, chlosterine impregnates it, and calcium helps to obliterate the arterioles. The veins are similarly attacked not only in the retina but in the choroid as well. The hemorrhages are situated in all layers of the retina, including that of the pigment epithelium and of the rods and cones. The exudate is fibrinous. The average age of retinopathic diabetic patients is lower than that of the average age of all diabetics and, in addition, the disease has existed longer in them. Morris Kaplan.

Purper, Heinz. **A rare finding in the vitreous body.** Klin. Montasbl. f. Augenh. **116**:85-86, 1950.

In the anterior part of the vitreous close to the posterior pole of the lens of the left eye of a ten-year-old boy, a delicate globe 2 mm. in diameter was seen. Its mulberrylike surface was covered with golden-yellowish pigment and it was divided into numerous cysts. A thin thread connected the structure with the upper lens at its equator above the ciliary body and it was only slightly moveable. The fundus was entirely normal, the vision was perfect, and there was no scotoma.

R. Grunfeld.

Rubino, A. **Perimetric changes in retinal pigmentary degeneration.** Giorn. ital. oftal. **2**:417-426, Nov.-Dec., 1949.

The author discusses in detail the behavior of the visual field in the early

stages of retinal pigmentary degeneration, emphasizing above all the bilateral and symmetrical aspects of perimetric changes. Vito La Rocca.

Santoni, A. **Surgical therapy in retinal detachments.** Giorn. ital. oftal. **3**:161-182, May-June, 1950.

In the cases in which detachment was present without a visible tear, the author looked first for a possible beginning of complete reattachment of the retina and second tried to identify the sector or sectors where the detachment had its beginning. Following these routes "a barrage" was done with the usual technique. Vito La Rocca.

12
OPTIC NERVE AND CHIASM

Falconer, M. A., and Pierard, B. E. **Failing vision caused by a bony spike compressing the optic nerve within the optic canal.** Brit. J. Ophth. **34**:265-281, May, 1950.

Two almost identical cases are described. Two large, middle-aged women complained of unilateral, progressive failure of vision. Each had a typical Morgagni's syndrome, which occurs almost entirely in women and consists of hyperostosis frontalis interna, obesity, hirsutness and, most frequently, neuropsychiatric symptoms. The cause is obscure but it is believed to be a disturbance of the hypothalamic and pituitary functions. In these cases there was a large constant temporal defect in the field. X-ray studies revealed numerous osteophytes projecting from the inner table of the skull and each showed very clearly a large bony spike projecting into the optic foramen and presumably compressing the optic nerve. In each the visual improvement was quite marked and the patients were relieved of all symptoms after a large decompression of the bony optic canal. Morris Kaplan.

Klauder, J. V., and Meyer, G. P. **Early diagnosis of syphilitic primary optic nerve atrophy.** Arch. Ophth. **43**:537-552, March, 1950.

The earliest signs of syphilitic optic nerve atrophy, the prodromal symptoms and the pitfalls in early diagnosis are discussed. The authors have rarely observed optic nerve atrophy in a syphilitic patient who had no neurologic abnormalities of neurosyphilis and whose spinal fluid gave no evidence of the disease.The most frequent prodromal symptoms of optic nerve atrophy were pain in the legs and diplopia. Other authors have reported loss of dark adaptation and a visual field defect that precedes loss of central vision and pallor of the optic disc as the earliest evidence of syphilitic optic nerve atrophy. Perimetric studies with small (1 and 3 mm.) white test objects will elicit the presence of very early functional loss, comparable to quantitive studies with colored test objects. It is necessary that ophthalmologists and all physicians who examine patients with syphilis have a high degree of awareness of the optic nerve and "reach out" for the diagnosis in the preatrophic stage of impending optic nerve atrophy. In order that the diagnosis of optic nerve atrophy may be made early, ophthalmologic and perimetric examinations should be made on all patients with neurosyphilis whether the serologic reactions of the blood and spinal fluid are positive or negative. Any physician can detect pupillary abnormalities. If they are found, examinations of the spinal fluid should be made to exclude optic nerve atrophy. It is far better for the patient that his syphilitic infection be evaluated in relation to early stages of the devastating forms of the disease—cardiovascular syphilis, neurosyphilis and optic nerve atrophy—than in terms of positive or negative serologic reactions.

R. W. Danielson.

Loddoni, G. **Apparent blindness of the newborn.** Atti d. 37 Congresso Soc. ital. oftal. **10**:148-150, 1948.

Two cases are reported of gray atrophy of the optic nerve due to late myelinization in infants, 10 and 12 months of age. Both developed normal nerve heads in a few months. (References.)

Frederick C. Blodi.

Smith, A. R. **Optic atrophy following inhalation of carbon tetrachloride.** Arch. Indust. Hyg. **1**:348-351, March, 1950.

The meager literature on the subject of carbon tetrachloride and the eyes, establishes the possibility of injurious effects on the optic nerve. Toxic amblyopia, pallor of the discs, bilateral constriction of the visual fields and, experimentally, fatty degeneration of the optic nerve have all been reported. Optic atrophy occurred in three workers exposed to carbon tetrachloride. In the first case, constitutional symptoms characteristic of carbon tetrachloride poisoning had definitely preceded the failure of vision. In the second there was a definite history of exposure preceding the onset of the impairment of vision, but no clinical evidences of systemic poisoning were recorded. In the third case the history is less definite. All three patients, however, were known to have been exposed to considerable amounts of carbon tetrachloride, and no other etiologic agent was ever discovered to account for the ocular conditions. Individual responses evoked by inhalation of carbon tetrachloride are known to be varied and unpredictable. In a case reported by Gray the impairment of vision preceded other symptoms of poisoning by two months in a man who remained at work during this time. Theodore M. Shapira.

Wong, R. T. **Acute retrobulbar neuritis: report of two cases.** Arch. Ophth. **43**:454-457, March, 1950.

In two patients with bilateral acute retrobulbar neuritis subsequent recovery of vision occurred. E. J. Swets.

13

NEURO-OPHTHALMOLOGY

Dennis, R. H., and Calkins, L. L. **Optic neuroencephalomyelopathy (Devic's disease).** Arch. Ophth. **42**:768-775, Dec., 1949.

A case of Devic's disease in a 45-year-old man is reported. He had bilateral loss of light perception and ascending sensory and motor paralysis. There was edema of the optic discs and surrounding retina. The motor paralysis eventually involved the respiratory muscles. Death occurred five weeks after the onset of the disease. Attempts to isolate an etiologic agent in this case were unsuccessful. Pathologic studies showed demyelination of the optic nerves, the spinal cord and the subcortical white matter. John C. Long.

D'Ermo, F. **Surgical cure of two patients with jaw-winking.** Atti d. 37 Congresso Soc. ital. oftal. **10**:109-112, 1948.

The method applied was the ptosis operation according to Hess which was modified by Bietti. The important point is to sever Mueller's muscle from its insertion. The good results seem to confirm Spaeth's theory that the efferent path of this reflex goes over the sympathetic nerve. Frederick C. Blodi.

Leinfelder, P. J. **Misconceptions in neuro-ophthalmology.** Wisconsin M.J. **49**:297-298, April, 1950.

Every patient with unexplained loss of visual acuity or with motor anomalies of the eye should be subjected to careful neuro-ophthalmologic examination with repeated visual field studies. Edema of the nerve head in brain tumors is discussed. If true edema of the nerve head persists three weeks post-operatively it is felt that surgical interference has not been adequate. Bitemporal hemanopsia may be due

to a primary lesion in the region of the sella turcica or may be due to obstruction of the acqueduct of Sylvius with dilatation of the third ventricle and pressure on the optic chiasm. Herman C. Weinberg.

Levitt, J. M. **Aneurysm of the internal carotid artery simulating tumor: report of a case.** Arch. Ophth. **43**:500-502, March, 1950.

A case is reported to demonstrate that aneurysm of the internal carotid artery before rupture produces a syndrome that greatly resembles that of neoplasm of the base of the skull. Severe ocular pain and frontal headache in the presence of a paralysis of the third nerve should suggest the possibility of an aneurysm of the internal carotid artery. The final diagnosis rests on the results of roentgenologic and arteriographic findings. E. J. Swets.

Morone, G., and Andreani, F. **Pupillographic studies of the Horner syndrome.** Atti d. 37 Congresso Soc. ital. oftal. **10**: 190-191, 1948.

A pupillographic study of the reactions of a Horner pupil to various drugs is reported. Frederick C. Blodi.

Ohm, J. **Nystagmus in diseases of the retina and the optic nerve.** Arch. f. Ophth. **150**:165-177, 1950.

Thirty-one cases are tabulated. They represent 1.7 per cent of the author's cases of non-industrial nystagmus. Nystagmus was found combined with retinitis pigmentosa, foci in the retinal periphery, optic atrophy and glaucoma simplex. Ernst Schmerl.

Rosen, Emanuel. **Immunological significance of demyelination of medullated nerve fibers of the eye.** Brit. J. Ophth. **34**:242-245, April, 1950.

A patient was seen in an acute toxic condition with acute edema of the posterior portion of the retina and medullated nerve fibers above and below the disc of each eye. The nerves went on to bilateral optic atrophy and disappearance of the medullated nerve fibers followed.

There is a certain similarity between demyelinating disease and experimental encephalomyelitis produced by repeated injections of heterologous brain antigen. The latter experiments were compared to the experimental production of the pneumonic encephalitis in which the product of a pneumonitis liberates a factor which produces an intravascular clotting in the cerebral vessels. Orwyn H. Ellis.

Ross, J. V. M. **Herpes zoster ophthalmicus sine eruptione.** Arch. Ophth. **42**:808-812, Dec., 1949.

Two cases of herpes zoster ophthalmicus without skin eruption are reported. Both patients developed severe corneal lesions with anesthesia and ulceration and also third nerve paralysis. Treatment did not seem to influence the course. Enucleation became necessary in one because of glaucoma and severe pain. The other patient recovered with 20/200 vision. The etiology is discussed. John C. Long.

Stadlin, W. **Hemianopsia and optokinetic nystagmus.** Ophthalmologica **118**: 383-388, Oct.-Nov., 1949.

In a case of brain tumor in the right parieto-occipital region the preoperative examination revealed leftsided homonymous hemianopsia, bilateral papilledema and normal optikinetic nystagmus in both directions. After surgical removal of a large astrocytoma the patient developed a left hemiplegia and hemianesthesia and the optokinetic nystagmus changed significantly: It occurred in normal fashion to the right, that is when the vertical bars entered the patient's field from the right. The quick component to the left when the bars appeared from the left side could not be elicited. The

pathways for optokinetic nystagmus are discussed. Peter C. Kronfeld.

Venco, L., and Morone, G. **Pupillotonia.** Rassegna ital. d'ottal. **19**:24-34, Jan.-Feb., 1950.

Three cases of disturbance of motility of the iris are reported. The signs of typical pupillotonia are emphasized and attention called to the numerous atypical forms of behavior of the pupil. These conditions are much more frequent in women and the etiological factors are usually obscure. Eugene M. Blake.

14

EYEBALL, ORBIT, SINUSES

Gans, M. E., and Gans, J. A. **Unilateral thrombosis of a cavernous sinus treated with penicillin and sulfadiazine.** Arch. Ophth. **42**:801-807, Dec., 1949.

The patient, a man of 58 years, developed a thrombosis of the left cavernous sinus after a skull fracture. The onset was insidious and the full picture required over three weeks to develop. Early symptoms consisted of headache, unilateral paralysis of the sixth nerve and faint homolateral conjunctival edema. Later proptosis and gross orbital edema developed with pallor of the disc and turbidity of the vitreous. Therapy consisted of intensive and prolonged administration of penicillin and sulfadiazine. The patient survived but the eye was totally blind and its motility was impaired. John C. Long.

Miklós, A. **The cure of cavernous sinus thrombophlebitis.** Brit. J. Ophth. **34**:235-241, April, 1950.

The authors present two complete case reports of thrombophlebitis of the cavernous sinus successfully treated with combined systemic and intrathecal penicillin injections. Systemic treatment, only, is indicated in the mild cases and in the more advanced cases the combined treatment. It is important that the treatment be continued until the cell count in the spinal fluid is below 100, as serious and even fatal relapses may occur. At this time the patient will have shown no fever for several days and the eye symptoms will be subsiding. Transfusions are given daily as an adjunct to the penicillin treatment. Orwyn H. Ellis.

Summerskill, W. H. **The exploration of the orbit.** Brit. J. Ophth. **34**:292-302, May, 1950.

The usual routes of access to an orbital tumor have been by the Krönlein osteoplastic resection or by the transconjunctival route described by Reese; both are considered inadequate and a modification of the transconjunctival approach is described which is designed to give considerably greater access to all parts of the orbital cavity. A free lateral canthotomy is carried out down to the orbital margin and the lateral palpebral ligament and fascia are freed from their attachment to the periosteum. The horizontal incision in the conjunctiva may be extended upward or downward or may be continued around medially if necessary. Digital examination can easily be done through the incision deep into the muscle cone; if a tumor is palpated, the external rectus is cut, the eye fully adducted and the space within the muscle cone fully exposed. Through this same approach, enucleation or a complete extenteration can easily be carried out if either is discovered to be necessary.

Eight case reports illustrate most retrobulbar conditions met with. Morris Kaplan.

Taptas, J. N. **Etiology and pathogenesis of exophthalmos of vascular origin, the so-called pulsating exophthalmos.** Arch. d'opht. **10**:22-50, 1950.

The author states that since 1809 more than 800 observations of this disease have been reported in the literature and that its

clinical characteristics are well known. Its mechanism of production is little understood, however. The general belief that a rupture of the internal carotid into the cavernous sinus is always responsible has not been borne out by autopsy or arteriographic findings. In 60 cases analyzed on the basis of autopsy or arteriography, the presence of an arteriovenous communication was verified in only 48 percent. In 45 percent other diverse vascular lesions existed such as ectasias and arterial or venous thrombosis. According to the author, the essential cause of the lesion, in both the spontaneous and posttraumatic cases, is a reflex vasodilatation. If there exists already a small arteriovenous communication it can become a true aneurysm. In cases with no such communication a carotid dilatation, isolated or associated with dilatations of the orbital veins, can create the same clinical syndrome. This neurovascular disease can be precipitated by such nonspecific factors as trauma. Phillips Thygeson.

15

EYELIDS, LACRIMAL APPARATUS

Bergler, Karl. **Operations for ptosis with special reference to Lexer's transplantation of fascia.** Arch. f. Ophth. **150**: 190-200, 1950.

Four cases successfully operated upon according to Lexer are presented.

Ernst Schmerl.

Bottasso, Giovanni. **Congenital abnormalities of the lacrymal puncta and canaliculi.** Rassgna. ital. ottal. **19**:94-100 March-April, 1950.

Three cases of congenital anomaly involving the portion of the lacrymal passages in the lower lid are described. In two patients there was a separate canaliculus above the normal one which opened into the lacrymal sac. In the third a similar supernumerary canaliculus ended blindly. The embryology is discussed, and the anomalies are ascribed to genetic distributions rather than intra-uterine inflammatory changes. Eugene M. Blake.

Caballero del Castillo, D. **New procedures in dacryocystorhinostomy.** Arch. Soc. oftal. hispano-am. **10**:249-255, March, 1950.

The improvement described concerns the suturing of the nasolacrimal flaps. The anterior flaps are sutured with a double suture, which is brought out through the skin 1 cm. from the incision and tied over glass beads; the advantage of this suture is the firm coaptation of the flap to the anterior tissues, which prevents its being pushed into the newly formed sac and blocking it. The posterior flap, which the author sutures occasionally, is also sutured with a continuous suture, the end of which is brought out through the nose and fastened with adhesive plaster on the nasal ala. The removal of the suture is thus made very simple. The author describes an improved wound retractor, which consists of the two arms, usually constituting a retractor, and has in addition a third movable arm, which can be fixed in any desired position to provide satisfactory exposure of the surgical field. (11 figures.) Ray K. Daily.

Contino, F. **The epitheliomas of the internal canthus.** Atti d. 37 Congresso Soc. ital. oftal. **10**:91, 1948.

This study is based on ten epitheliomas arising from the internal palpebral angle. The author prefers surgical excision to irradiation. Frederick C. Blodi.

Czukrász, Ida. **Congenital entropion due to epiblepharon.** Brit. J. Ophth. **34**: 318-319, May, 1950.

Epiblepharon, which is described as a skin fold in infants, generally in the lower lid, is seen relatively frequently while congenital entropion is exceedingly rare.

A 7-year-old boy is described who had both conditions in both lower lids since birth. At operation the orbicularis was found to be hypertrophic and was excised with a section of skin. The muscle hypertrophy and not the epiblepharon was the probable cause of the entropion.

Morris Kaplan.

Faldi, Silvano. **A case of a double unilateral lacrimal fistula.** Giorn. ital. oftal. 3:222-227, May-June, 1950.

The multiplicity of the malformation suggests that it is a congenital malformation which resulted from an abnormality of the nasolacrimal duct during the embryonic stage. Vito La Rocca.

Fazakas, S. **Modern principles in surgery of the lacrimal sac.** Szemészet 1:43-50, 1950.

The problem whether the sac should be extirpated or left in place cannot be solved without knowledge of the physiology of tear drainage. If the manometer does not display fluctuations, or the shape and size of the sac rendered visible by a radiopaque substance does not vary during nictitation, extirpation is the operation of choice. The author found a secondary fossa in front of the lacrymal fossa and the anterior lacrymal crista, and a secondary crista, in 21 percent of his patients. There were true fossae without a crista, and some patients with no true fossa but with a secondary fossa and crista. In some cases the fossa lay far backward. Thus, the topographic role of fossa and crista is less reliable than has been assumed. The inlet of the bony nasolacrymal duct is a reliable guide. To eliminate difficulty, the mobilized sac was inserted into the rhinostomy opening.

Gyula Lugossy.

Forsius, Henrik. **Ectropion operations for ichthyosis congenita.** Acta ophth. 27: 573-579, 1949.

The chief ocular disturbance in ichtyosis congenita is an ectropion and lagophthalmos, produced by the contraction of the skin of the lids; the eversion of the conjunctiva leads to a severe chronic catarrhal conjunctivitis, and superficial involvement of the cornea. The author reports a case in which the ectropion was corrected successfully by transplanting free grafts from the skin behind the ear and the skin of the chest into the lids. The unusual features of the operation were the difficulty of suturing the graft to the thickened skin and a peculiar bulging of the transplant for a few days after the operation. The procedure was used to lengthen all four eyelids. (4 figures)

Ray K. Daily.

Gutzeit, Richard. **Stone in the right lower tear duct in a man with bilateral juvenile cataract.** Klin. Monatsbl. f. Augenh. 116:77-78, 1950.

A small calcareous stone was found in the tear duct of a man who worked with cement and lime. R. Grunfeld.

Meyer, F. W. **Surgery of the tear ducts.** Klin. Monatsbl. f. Augenh. 116:79-81, 1950.

The author describes his experience with dacryocystectomy and with various dacryocystorhinostomies. For the latter he uses a modification of v. Blascovics' method. The author extirpates not only the nasal mucosa in the region of the nasal opening but the tear sack wall opposite the hole made in the nose as well. In cases of duct stenosis the author carefully extirpates the nasal mucosa opposite the hole and the entire tear sack and tear duct up to the place of stenosis. The operative results were gratifying.

R. Grunfeld.

Nielsen, E. T. **Congenital benign melanosis of the eye.** Acta ophth. 27:591-697, 1949.

The literature is reviewed, and a case reported. A woman, 32 years old, had a unilateral hyperpigmentation of the left iris and sclera; vision of the eye was normal. The hyperpigmentation manifested itself in map-like distribution of pigmented patches of a dull bluish purple to black color. Under the slitlamp they were seen to consist of distinct pigmented granules in net-like circumscribed groups. (2 figures) Ray K. Daily.

Roig. **Treatment of entropion through the conjunctival route.** Arch. Soc. oftal. hispano-am. **10**:260-264, March, 1950.

Roig describes a procedure for the correction of trachomatous trichiasis and entropion, which is frequently used in North Africa. In addition to the usual instruments, it requires the specially designed metallic plate of Tabut or Schousboe and Duguet, on which are fastened the sutures inserted at the palpebral border for the purpose of maintaining the lid in eversion. The procedure consists essentially of restoring the normal configuration of the tarsus by splitting it 2 mm. from the lid, and fixing the distal portion in the correct position by three double-armed sutures. Ray K. Daily.

Starke, Herbert. **Nida's operation for ptosis.** Arch. f. Ophth. **150**:182-185, 1950.

The author reports the results obtained in 19 operations on patients followed up for about one year. Since in several cases lagophthalmus, double vision or irregular astigmatism had occurred, the author prefers v. Blascovics' advancement of the levator to Nida's operation.

Ernst Schmerl.

Ulloa, M. G. **Correction of cicatricial ectropion by means of a skin graft placed over an artificially hyperdistended area.** Plast. and Reconstr. Surg. **5**:310-321, April, 1950.

The author believes that the papillo-epidermal graft (Thiersch) is the most advantageous cutaneous substitution and that its only disadvantage is the extreme postoperative shrinking of this graft (up to 50 percent) and the marked hyperpigmentation which follows. He has developed a procedure for stretching the defect in the lid to twice its size with sutures extending from the lid margin to a cephalic traction bar. An area of skin of papillo-epidermal thickness twice the size of the defect is taken from the external surface of the upper third of the thigh. It is applied to the defect, and the traction sutures are left in place for three days. The compressive bandages are then removed. For four to six weeks the lid is longer than normal, but it slowly and gradually shrinks until it assumes normal size and shape. The author recommends the use of alfa-tocoferol and inductothermy to promote vascularization of the graft. He does not mention intermarginal lid adhesions or the use of other lid skin for reconstruction. (27 figures, 72 references.) Alston Callahan.

Walser, Erwin. **Late results in Nida's operation with reference to Starke's report.** Arch. f. Ophth. **150**:186-189, 1950.

This report is somewhat more favorable but similar to Starke's presentation.

Ernst Schmerl.

16
TUMORS

Breinin, G. B. **The eye in teratomas: report of a case and review of the literature.** Arch. Ophth. **43**:482-499, March, 1950.

The case reported represents a type not previously described in ophthalmic literature in that the presence of ocular elements was noted in a malignant teratoma of the ovary. This tumor contained a well formed optic cup of which half resembled the cup of the normal embryonic

eye in the 15 mm. stage and the remainder closely resembled retinal neuroepithelioma. The rudimentary eyes in teratomas are nearly always malformed and of limited development. Dermoids may contain macroscopic ocular elements and most solid teratomas contain only microscopic elements. Choroid and retina are commonly found when the ocular elements are present; vitreous, eyelids, cornea, and sclera are occasionally found; and the lens is only rarely formed. Cases of malignant teratoma which closely resemble neuroepithelioma of the retina have been reported. E. J. Swets.

Di Ferdinando, Renato. **A case of bilateral subconjunctival lipoma.** Giorn. ital. oftal. **3**:109-117, March-April, 1950.

The author reports his clinical and histologic observations of a case of bilateral, symmetrical, subconjunctival lipoma. He also outlines the main characteristics of this rare tumor. Vito La Rocca.

Harbert, F. **Teratoma of orbit.** Arch. Ophth. **42**:451-460, Oct., 1949.

True teratomas are rare tumors containing tissue derived from all three germ layers. The author reports a case of teratoma of the orbit in an infant. The globe was proptosed and a hypopyon ulcer developed. Exenteration of the orbit was carried out. A retrobulbar mass was found measuring 5 by 4 cm. Convalescence was uneventful and no recurrence has been observed.

The tumor was a large cystic mass containing fat, bone, cartilage and many cysts lined with epithelium of different forms, which included squamous epithelium with many hair follicles and sebaceous and sudoriferous glands, ciliated columnar and cuboidal epithelium and mucous membrane with a papillary structure and arrangement characteristic of intestine. There were also small scattered glands of the racemose type, resembling salivary or lacrimal glands. John C. Long.

Magni, Sallustio. **Reticulohystiocytoma of the conjunctiva.** Giorn. ital. oftal. **2**: 427-445, Nov.-Dec., 1949.

Magni, after briefly discussing the evolution of these tumors and the morphologic data which characterize them, describes three cases of reticulohystiocytoma, two of which were found in the epibulbar conjunctiva, and one in the lower conjunctival fornix.

Vito La Rocca.

Milner, J. G., and Langley, D. A. **An unusual case of retinal detachment.** Brit. J. Ophth. **34**:320-321, May, 1950.

A 48-year-old man had what appeared to be a complete detachment of the retina of the right eye. The subretinal fluid was evacuated and found to contain no malignant cells and transillumination was quite clear throughout. When the retina fell back into place a large solid tumor was revealed below and the eye was removed. In pathologic studies a spindle-celled malignant melanoma of the choroid with invasion of the sclera was found.

Morris Kaplan.

Reeh, M. J., and Swan, K. C. **Experiences with tumors of the lid.** Tr. Am. Acad. Ophth. pp. 312-325, March-April, 1950.

Many so-called rodent ulcers should more properly be diagnosed as adnexal carcinomas, since they really arise from the embryonic forms of skin adnexa, such as hair follicles, sebaceous and suderiferous glands. These tumors have a low degree of malignancy and are usually limited by the underlying fascial sheath. The lesions classically occur in the lower lid near the inner canthus, and have an elevated telangiectatic border and a central portion which is subject to recurrent ulceration. The importance of biopsy and

microscopic determination of the degree of malignancy is emphasized. Adnexal carcinomas respond well to roentgen therapy, although under-treatment is a common pitfall when radiation is employed. The underlying fascia should not be disturbed when the tumor is excised. This lesion should never be treated by cauterization or fulguration. Squamous cell and pigmented tumors of the lids are briefly discussed. Gustav C. Bahn.

Toselli, Carlo. **Malignant, bilateral melanoma of the choroid.** Rassegna ital. d'ottal. **19**:88-93, March-April, 1950.

A 55-year-old man presented the usual fundus picture of a malignant melanoma in the left eye. The enucleated globe showed a typical round-celled melanoma of the choroid. Several months later pain in the sacroiliac region was shown, by X-ray examination, to be due to malignant destruction of the joint and at this time examination of the second eye disclosed a retinal detachment with a dark mass beneath. A biopsy of the tissue in the middle meatus of the same side showed melanotic newgrowth. Metastatic melanoma of the choroid was diagnosed. Less than a dozen instances of bilateral melanoma are on record. Extensive laboratory studies of the blood and urine are reported in this case. Eugene M. Blake.

Wright, C. J. E. **Prognosis in cutaneous and ocular malignant melanoma; study of 222 cases.** J. Path. and Bact. **61**:507-525, Oct., 1949.

This study of 222 cases of melanoma of which 86 are ocular in origin, covers a period of 23 years. The prognosis was worse in the later age groups in malignant melanoma of both skin and eye. 62.5 percent of the patients with tumor that originated in the eye survived five years, and 39.4 percent ten years.

The larger ocular tumors tend to have the worst prognosis and are only slightly less deadly than the diffuse melanomas of the uveal tract. The more deeply pigmented tumors showed a higher mortality than did those of the epitheloid-cell type. Where the tumor showed extraocular growth there was average survival of less than two years. Involvement of the optic nerve is not necessarily a bad prognostic sign. There was orbital recurrence in 8.3 percent of the cases with an average survival period of one year and four months. (16 figures, 9 tables.)

Herman C. Weinberg.

17

INJURIES

Knüpffer, Nicholai. **Rare X-ray lesions in the eye and its surroundings.** Klin. Monatsbl. f. Augenh. **116**:66-77, 1950.

The author presents the case histories of four patients who suffered X-ray lesions of the eye and adnexa. In two patients radiation therapy for lid carcinoma was followed by deeply penetrating bone necrosis. The third patient was treated for tumor of the hypophysis. Signs of X-ray lesion were the increased skin pigmentation on both temples, loss of eyelashes and eyebrows and typical X-ray cataract in both eyes. The retina, which is very resistant to the action of X rays and is rarely affected, received X-ray damage, too. There was temporal pallor of the optic disc in one eye and optic atrophy in the other. In one eye there was also macular edema surrounded by retinitis circinata and sclerosis of the vessels, lesions simliar to those seen in experimental X-ray damage. R. Grunfeld.

Lock, J. A. N. **Complication of traumatic hyphaema.** Brit. J. Ophth. **34**:193, March, 1950.

Secondary glaucoma following hyphema after trauma in a young girl here is described briefly. The bleeding was made worse when atropine was used. The

dilatation reopened a bleeding point on the iris. Repeated hemorrhage occurred until paracentesis was carried out to evacuate a large clot. Morris Kaplan.

de Michele, T. **An intraocular strand of fibrous tissue after a perforating injury.** Atti d. 37 Congresso Soc. ital. oftal. **10**: 105-108, 1948.

A strand of fibrous tissue extended from the disc to a mass of white tissue over the plane part of the ciliary body. The history was entirely negative. The X-ray film revealed an intraocular foreign body and this fibrous strand is probably caused by the injury. Frederick C. Blodi.

Santoro, Nicola. **Diffuse siderosis of the eye caused by a foreign body in the optic nerve.** Giorn. ital. oftal. **2**:384-389, Sept.-Oct., 1949.

A metallic foreign body embedded in the optic nerve provoked immediate and extensive siderosis of the eye.

Vito La Rocca.

18

SYSTEMIC DISEASE AND PARASITES

Alagna, G. **Quinine intoxication and the eye.** Atti d. 37 Congresso Soc. ital. oftal. **10**:37-43, 1948.

Pursuing his experimental and clinical studies with riboflavin, the author has successfully treated a case of acute quinine intoxication with markedly decreased vision. He could repeat his results on experimental animals in which vitamin B_2 protects the retina and the optic nerve against the degenerations produced by the quinine. The histologic picture of the control eyes suggests a direct action of the quinine on the nervous tissue. (References.) Frederick C. Blodi.

Azzolini, U., and Pascucci, F. **Streptomycin and gold in the therapy of Reiter's disease.** Giorn. ital. oftal. **3**:17-23, Jan.-Feb., 1950.

The authors emphasize the good results obtained with streptomycin therapy in the acute stage of Reiter's disease and report such a case. They discuss the results observed in the chronic form in two cases reported by them two years ago, in which the streptomycin was of use for lesions in the mucous membranes, but not in the joints, where gold therapy was effective. Vito La Rocca.

Barnes, R. H. **Capillary fragility studies in diabetes mellitus and the use of rutin in diabetic retinitis.** Am. J. M. Sc. **219**: 368-375, April, 1950.

A positive pressure method for testing capillary fragility is described. 220 diabetic patients were examined for diabetic retinitis, hypertension, and capillary fragility. 76 patients were treated with rutin for periods varying from 6 weeks to 33 months.

Long duration of diabetes and hypertension with poor control of the diabetes seem to lead to early retinitis. Rutin seemed to have little effect in improving capillary fragility or diabetic retinopathy. Retinitis proliferans may progress during rutin therapy. Further study of rutin is advised. (1 figure, 2 tables.)

Herman C. Weinberg.

Cardello, G. **Ocular symptoms in subarachnoidal hemorrhages.** Atti d. 37 Congresso Soc. ital. oftal. **10**:72-73, 1948.

The author presents two more cases. He does not believe that the ocular symptoms (hemorrhages, papilledema) can be explained on a purely mechanical basis but thinks that they are an expression of a more generalized hemorrhagic diathesis, perhaps on an endocrine basis.

Frederick C. Blodi.

Cristine, G., and Roversi, L. **Lipoid and protein metabolism and methylization**

processes in diabetic retinitis. Acta ophth. **27**:563-572, 1949.

The laboratory data on ten cases of diabetic retinitis are reported in tabular form. The protein metabolism was determined by Wu-Ling's method, the metabolism of the lipoid fractions by the method of Katsura, Hatakeyama and Tajima, and of the methylization process by the method of Ciusa-Dessi. The analysis of the data shows that the protein metabolism shows no significant deviation from the normal and plays no role in the retinal changes in diabetes. The lipoid metabolism on the contrary shows consistent change, particularly that of neutral fat, which is markedly increased. The phosphate data are inconstant, the content greatly increased in four cases, and normal or even slightly diminished in six. The methylization process shows a definite disturbance. It is suggested that diabetic retinopathy is associated with a disturbance in the metabolism of neutral fat and of the methylization process. It is possible that the inadequate methylization modifies the lecithin content, which takes part in preventing fatty infiltration. The therapeutic administration of cholin compounds in diabetes seems advisable.

Ray K. Daily.

Esente, Ivan. **The clinical significance and value of ophthalmoscopy in tuberculous meningitis treated with streptomycin and P.A.S.** Giorn. ital. oftal. **3**:27-37, Jan.-Feb., 1950.

Ophthalmoscopic observations of more than 300 patients with tuberculous meningitis who had been followed for a period of more than two years after streptomycin and chemiotherapy revealed vascular, choroido-retinal, and disc changes in 95 percent of the cases. Vito La Rocca.

Lisman, J. V. **Rheumatoid involvement of the extraocular muscles.** Arch. Ophth. **42**:410-415, Oct., 1949.

A young white girl had repeated episodes of diplopia with remissions over a period of several years. The diplopia was due to paresis of individual muscles. There was pain on looking into the field of the paretic muscle, and tenderness to palpation over it. Exophthalmos, edema of the lids, chemosis and pain were evidence that Tenon's capsule was involved in several episodes. There was repeated association of ocular involvement with migratory polyarthritis, erythema nodosum, fever, rapid sedimentation time and subcutaneous nodules. It was thought that the ocular involvement was on a rheumatoid basis. John C. Long.

Missiroli, G. **Clinical considerations concerning the removal of subretinal cysticerci; particularly late results.** Boll. d'ocul. **28**:705-726, Dec., 1949.

Eight of the surgically treated cases of subretinal cysticercus were observed for more than one year. If the parasite is near the posterior pole of the eyeball and subretinal, as it often is, the following procedure was used (Cavara). Wide incision and undermining of the conjunctiva and of Tenon's capsule that gives access to the seat of the parasite is done, if necessary, with tenotomy of one rectus muscle. After exact localization with the ophthalmoscopic method of Weve a Graefe-knife incision 4 to 5 mm. long is made in the sclera in one meridian. The length of the incision must not surpass the diameter of the sac containing the cysticercus. The choroid is opened with the same knife; if the parasite does not appear immediately, two Daviel spoons may help the delivery by mild pressure from both sides of the wound. Eight good illustrations show the fundus before and after operation, and the steps of the operation. K. W. Ascher.

Noto, P. **Kaposi's disease with ocular alterations.** Giorn. ital. oftal. **3**:204-210, May-June, 1950.

A case of Kaposi's disease is reported

in which there were bilateral vascular lesions of the lanunar type in the bulbar conjunctiva, and remarkable pigmentary deposits with blurred edges, crossed by a crowding of small and dilated vessels in the uveal tissue as well as the usual manifestations in the skin. Vito La Rocca.

Robinson, H. M., and McCrumb, F. R., Jr. **Comparative analysis of the mucocutaneous-ocular syndromes: report of eleven cases and review of the literature.** Arch. Derm. and Syph. **61**:539-560, April, 1950.

Eleven cases of the mucocutaneous-ocular syndromes are reported. The literature is reviewed and the similarity between case reports of Behcet's disease, Reiter's disease, Stevens-Johnson disease, and ectodermosis erosiva pluriorificialis suggest that these are all variations of erythema multiforme exudativum. Because of the outstanding finding of rheumatoid arthritis and arthralgia in Reiter's disease it may be classified separately from the other mucocutaneous-ocular diseases. (10 tables.)

Herman C. Weinberg.

Sala, Guido. **Ocular signs of hepatolenticular degeneration.** Riv. oto-neuro-oftal. **25**:1-11, Jan.-Feb., 1950.

Hepato-lenticular degeneration which shows symptoms in common with Westfall-Strumpell pseudosclerosis and Wilson's disease is an affection of the extrapyramidal nervous system frequently associated with the corneal ring of Kayser-Fleischer, typical cataract and hepatic cirrhosis with large nodules. The ring is a bilateral formation of fine pigment granules in the deep layers of cornea varying in color from orange yellow to greenish or blue. The cataract is formed by a bilateral turbidity of the anterior surface of the lens, more marked in the anterior polar area, with radiations toward the equator. It is visible in focal illumination and biomicroscopically but not so clearly visible ophthalmoscopically. The cataract is similar to that of chalcosis. The chemical nature of the two formations is discussed.

Melchior Lombardo.

Schreck, Eugen. **Ecthyma gangraenosum (Kreibich) and the eye.** Klin. Monatsbl. f. Augenh. **116**:35-43, 1950.

The author describes a case of ecthyma gangraenosum (Kreibich) in a premature infant. It started on the upper lip and extended to the face. It rapidly destroyed the eyelids, the orbit, and the cornea and was followed by anergic panophthalmitis. The infant died 17 days after birth. The eyes are described histologically.

Ecthyma gangraenosum is a skin disease. Bluish or red-brown, lentil to dollar-size hemorrhagic nodules appear in the skin which quickly break down to punched out ulcers with a sharp margin and then rapidly extend in width and depth and become confluent. The areas of predilection are the trunk, back, nates, genital organs, armpit, and face. The upper layer of the skin is raised in vesicle formation from the papillae. The vesicles are filled with nuclear remnants, serum and intact red cells. Below the vesicle in the hemorrhagic papilla and in the swollen corium innumerable bacilli are found. The elastica is unharmed. The deep cutis is infiltrated with small-celled nodules. One of the chief characteristics of the histologic picture is that the vessel walls of the affected area are infiltrated and surrounded by a swarm of bacilli. From a bacteriologic standpoint it is a symbiotically activated mixed infection of streptococci and colon bacilli. R. Grunfeld.

Thies, Oskar. **The eye in erythema exudativum multiforme.** Klin. Monatsbl. f. Augenh. **116**:44-53, 1950.

The author describes two patients with erythema exudativum multiforme with involvement of the eyeballs. The one exhibited all the characteristics of the dis-

ease with vesicle and pseudomembrane formation on the skin, mouth, urethra, and eye but healed without conspicuous scar formation. The other was free from skin involvement, showed vesicles only in the corner of the mouth, oral mucosa, lips, tongue, uvula, and pharynx, but the eye was severely affected. The cornea was ulcerated and had to be cauterized to prevent perforation. Iritis and uveitis supervened. Eventually the lesions healed with severe scar formation, deformation of the tarsi and dense opacities.

R. Grunfeld.

19

CONGENITAL DEFORMITIES, HEREDITY

Agnello, F. **Froehlich's syndrome associated with congenital microphthalmos and coloboma of the choroid.** Atti d. 37 Congresso Soc. ital. oftal. **10**:31-36, 1948.

This is a report of a 19-year-old girl with an adiposo-genital dystrophy and microphthalmos of the right eye and choroidal coloboma in the left one. The author concurs with Cavalacci in explaining this association on an embryologic basis and emphasizes the common diencephalic origin of a part of the pituitary gland and of the eye.

Frederick C. Blodi.

Bucciolini, M. G. **A supernumerary tooth in the orbital cavity.** Giorn. ital. oftal. **3**:59-66, Jan.-Feb., 1950.

A supernumerary and inverted canine tooth was removed from the orbital cavity. The dental anomaly was associated with congenital unilateral microphthalmos.

Vito La Rocca.

Edmunds, R. T. **Vision of albinos.** Arch. Ophth. **42**:755-767, Dec., 1949.

Complete albinism, a genetic recessive trait, is always accompanied by ocular defects. The lack of pigment causes photophobia, and amblyopia and nystagmus are due to the defective foveal region. Astigmatism and ametropia, while not directly related to the albinism, are correlated with it. Albinism does not cause color blindness, although the poor acuity often results in low color discrimination. Form fields are usually somewhat contracted. Dark adaptation is fairly normal. The average visual acuity found in 16 subjects was 20/200. Contact lenses that are opaque except in the pupillary area offer the simplest means for enhancing vision.

John C. Long.

Faldi, S. **A typical case of Marfan's syndrome.** Giorn. ital. oftal. **3**:38-58, Jan.-Feb., 1950.

Faldi believes that an alteration observed at the earliest stage of growth at the anterior pole of the embryo is the pathogenic base of the syndrome and that one must recognize the importance of the organizing center as a regulator of growth, which in man has function associated with the diencephalon.

Vito La Rocca.

Morganti, G., and Musini, A. **Heredity of congenital unilateral blepharoptosis.** Atti d. 37 Congresso Soc. ital. oftal. **10**: 170-172, 1948.

The author gives two examples of the dominant transmission of unilateral ptosis. In one family it was associated with syndactylism and may therefore be regarded as an instance of the "status dysraphicus."

Frederick C. Blodi.

Valerio, Mario. **Congenital cataracts and other malformations after maternal rubeola.** Giorn. ital. oftal. **2**:368-379, Sept.-Oct., 1949.

Valerio reports the first case noted in Italy, with a bilateral congenital cataract, persistence of the foramen of Botallo and with serious signs of immaturity.

Vito La Rocca.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Amsler, Marc. **The centenary of the ophthalmoscope.** Arch. d'opht. **10**:68-69, 1950.

Amsler notes that there is uncertainty regarding the exact date of the invention of the ophthalmoscope. The date generally assigned is 1851 which was the date of the publication of the monograph describing the instrument and also the date of Helmholtz's first public presentation of it at a meeting in Koenigsberg. However, in a letter to his father dated December 17, 1850, Helmholtz, then 29 years of age and professor of physiology at Koenigsberg, described his invention in some detail and commented on its practical value to ophthalmologists. Amsler concludes that the celebration planned for the International Congress at London this summer is historically justified. Phillips Thygeson.

Esser, Albert. **History of the discovery of the ophthalmoscope.** Klin. Monatsbl. f. Augenh. **116**:1-14, 1950.

The author clarifies with documentary evidence some uncertainties concerning the exact dates of the discovery of the ophthalmoscope. Helmholtz conceived the idea relating to the discovery in the first weeks of October, 1850, while he prepared lectures on the physiology of the senses. He publicized his discovery for the first time at the Physiological Society of Berlin on December 6, 1850. The article appeared in print in October, 1951, and the first public demonstration of the ophthalmoscope was given by von Helmholtz on Nov. 11, 1851, at the Society for Scientific Medicine in Koenigsberg.

R. Grunfeld.

Kuhn, H. S. **Safety eye wear: good practice and malpractice.** Tr. Am. Acad. Ophth. pp. 394, March-April, 1950.

Lack of standardization and substandard safety eye equipment has been found in many industrial plants because of economic pressure, false economy, and personal or family interest. The committee urges that only standard equipment be accepted by those responsible for the health of employees. Gustav C. Bahn.

Pandit, Y. K. C. **Human eyes and modern industry.** Tr. Am. Acad. Ophth. pp. 395-400, March-April, 1950.

Standardization of methods for evaluating and recording visual efficiency in industry is becoming increasingly important. 416 patients out of 714 referred to the eye clinic of the Tata Main Hospital in Bombay were found to have some visual defect. This group was analyzed from the standpoint of visual acuity of one or both eyes, and color blindness. Night blindness and color blindness were investigated with the idea of modifying illumination and color schemes in industrial plants in order that employees obtain maximal visual efficiency. No high incidence of nystagmus was noted in workers from mines. Gustav C. Bahn.

Siniscal, A. A. **Trachoma in Missouri.** Arch. Ophth. **42**:422-437, Oct., 1949.

An excellent brief history of trachoma is given, with a discussion of the incidence of this disease in the United States. Trachoma is still one of the principal factors in the causation of blindness in the state of Missouri, but its incidence is definitely declining. The Missouri Trachoma Hospital at Rolla is actively engaged in stamping out the disease. At present their treatment of choice consists in the internal administration of sulfadiazine or combisul combined with the local application of sodium sulfacetimide or NU-445 (gantrisin). The epidemiology, immunology, and social aspects of the disease are discussed. Differential diagnosis is discussed in detail. The control

and eventual eradication of trachoma will depend upon the discovery and treatment of all infected persons and unremitting conformity to principles of personal and ocular hygiene on the part of the patient and his family. John C. Long.

Wong, W. W. **Personality patterns in ocular discomfort.** Arch. Ophth. **42**:443-450, Oct., 1949.

The most frequent reason that patients seek the services of an ophthalmologist is their inability to use their eyes with comfort. Some of these patients suffer from ocular disease or refractive errors and respond to suitable treatment. There is, however, another large group of patients whose complaints are real and whose symptoms cannot be relieved by merely treating the patients as rigid optical instruments. The patients usually have personality characteristics of a definite pattern. Women predominate over men in a ratio of about 8 to 2. They are perfectionists and their habits and actions are orderly and well planned. Their unyielding approach to life makes readjustment and compromise difficult, so that, rather than adapt themselves to a difficult situation in life, they resist and balk at the expense of their emotional system. After excluding organic ocular disorders by a careful examination, the diagnosis is made by a careful history. Onset of symptoms can often be dated to some difficult situation in life. They may be relieved by helping them to understand their emotional background and directing their energies into less conflicting channels.

John C. Long.

Ophthalmic Miniature

In inflammations of an acute kind attacking the globe, an unnatural hardness is perceptible on pressure, usually accompanied by that dull sickening pain which attends distention of the fibrous tissues, and referable in this case, I suppose, in a great measure to the sclerotica and cornea. The unyielding nature of these coats occasions all internal distending forces to react in the way of counter-pressure on the parts within, impairing their function in the first instance, and soon irrecoverably destroying them, if allowed to continue unchecked. We have analogous phenomena in the case of other organs enveloped, like the eye, in a tunic incapable of hasty dilatation.

William Bowman,
Lectures on the Parts Concerned in the Operations of the Eye, 1847.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received by the editor at least three months before the date of occurrence.

Deaths

Dr. Sterling Frederic Mengel, Pottsville, Pennsylvania, died June 2, 1950, aged 48 years.

George W. Wallerich

George W. Wallerich, president of V. Mueller & Company, Chicago, Illinois, died July 3rd after a long illness. Mr. Wallerich, who was born April 3, 1880, had been a leader in the surgical instrument industry for more than 45 years; 40 years of this time were spent with the Chicago surgical instrument house which he joined as secretary shortly after his marriage to Vinzenz Mueller's daughter, Marie.

As a lieutenant colonel, later a colonel, Mr. Wallerich served with the Sanitary Corps, U. S. Army, in World War I. During World War II, he was a member of the National Research Council.

In professional circles, Mr. Wallerich's name was respected throughout the world by medical men who sought his aid in the development of new surgical instruments and equipment. Much of his time was spent in working out improvements in old instruments for surgery, and in developing new instruments for new techniques. Mr. Wallerich's intense interest in his work carried over into his personal life, and many of his closest friends were surgeons and hospital executives. He was, according to one of the latter, "a man of very high intellect and broader vision than the average man, a conscientious worker. . . ."

Announcements

Research grants-in-aid

The National Council to Combat Blindness, Inc., in the continuation of its established policy of financing ophthalmic research, announces that requests for grants-in-aid awards for the period of July, 1951, to June, 1952, are now being accepted. Applications should be in the office of the council no later than March 1, 1951. Appropriate forms may be obtained by writing to the secretary, National Council to Combat Blindness, Inc., 1186 Broadway, New York 1, New York.

Illinois meeting

The next meeting of the Central Illinois Society of Ophthalmology and Otolaryngology will be held at the Abraham Lincoln Hotel in Springfield, Illinois, on September 22nd, 23rd, and 24th.

The guest speakers will be Dr. Girolamo Bonaccolto of New York, who will give several lectures on ophthalmology, and Dr. Bayard T. Horton of the Mayo Clinic, who will speak on "histaminic cephalgia," and "treatment of retrobulbar neuritis with histamine." Dr. C. L. Pannabecker and Dr. A. L. Paisley, members of the society, will also speak.

College of Surgeons meeting

The 15th annual assembly of the United States chapter of the International College of Surgeons will be held in Cleveland, Ohio, October 31st to November 3rd, with headquarters at the Cleveland Hotel.

Surgical clinics will be held in several Cleveland hospitals on Monday, October 30th. All scientific sessions will be held at the Cleveland Public Auditorium, 9:00 a.m. to 5:00 p.m., Tuesday through Friday. A fine colored television program of surgical procedures, originating from the St. Vincent's Charity Hospital, Cleveland, will be shown daily in the auditorium from 9:00 a.m. to 1:00 p.m. Motion pictures will also be presented each day depicting many of the recent advances in surgery and surgical technique.

Reservations may be obtained by writing to the Committee on Hotels, International College of Surgeons, 511 Terminal Tower, Cleveland 13, Ohio. Preliminary programs may be obtained from the central office, 1516 Lake Shore Drive, Chicago 10, Illinois.

International association's new address

The offices of the International Association for Prevention of Blindness have been transferred to 47 Rue de Bellechasse, Paris, France.

Personals

Dr. Algernon B. Reese, clinical professor of ophthalmology, Institute of Ophthalmology, Columbia University, gave the fifth Francis I. Proctor Lecture at the University of California School of Medicine, San Francisco, on September 15th. The subject of Dr. Reese's address was "Retrolental fibroplasia."

On June 12, 1950, Dr. Arthur J. Bedell was given the honorary degree of Doctor of Science by the University of the South. Shortly thereafter he left for Europe where he exhibited hundreds of his famous photographs at the 16th International Congress of Ophthalmology. He opened the discussion on, "The role of the sympathetic system in the genesis of vasular hypertension and its effect upon the eye."

The Guild of Prescription
Opticians of America, Inc.

cordially invites you
to attend its exhibit

Sources of Patient Complaints,
Arising from Dispensing Procedures

at Booth No. 47, in the Main Hall, at
The 55th Annual Meeting
of
The American Academy of Ophthalmology
and Otolaryngology
at
The Palmer House
Chicago, Ill.
October 8 through October 13, 1950

The Guild of Prescription
Opticians of America, Inc.
110 E. 23rd Street New York (10) N.Y.

25 YEARS

storz
Surgical Instruments

Lancaster Red-Green Test

No. 900
Complete for 110-volt AC current in case with screen $81.00

No. 910
Complete for five dry cells in case with screen $73.50

A tangent screen marked off in 70mm. squares for use at a two meter distance. Each square at this distance is equivalent to four prism diopters.

A pair of goggles with red filter for right eye and green filter for left eye. One projection unit throws a short red streak or dash of light, the other a green streak of light. Also a red-blue pencil and small duplicates of the tangent screen for recording the findings of the examination.

STORZ INSTRUMENT CO., 4750 Audubon Ave., St. Louis 10, Mo.

Thank you Doctor
for prescribing .
Obrig Superior Quality
Contact Lenses

Obrig Laboratories Inc.
49 EAST 51st STREET • NEW YORK, 22, N. Y.
BRANCHES IN
PHILADELPHIA . . . MONTREAL . . . LONDON
JOHANNESBURG . . . SHANGHAI

PRESCRIPTION OPTICIANS

ST. LOUIS, MO.

Erker Bros. Optical Co.

610 Olive Street

518 N. Grand Boulevard

and Clayton, Mo.

Prescription Opticians Since 1879

J. C. REISS, *Optician*

10 Hill St.
Newark 2, N.J.

12 Community Place
Morristown, N.J.

Established 1892

Oldest Optical House in New Jersey
Member Guild of Prescription Opticians of America.

CINCINNATI, OHIO

L. M. Prince Co.

Established 1872

Prescription Opticians
Sole makers of Coflexic
Corrected Curve Lenses

NEW YORK CITY

E. B. Meyrowitz
INCORPORATED

Optician Established 1875
520 Fifth Ave., New York
255 Livingston St., Brooklyn
Member Guild of Prescription Opticians of America

CHICAGO, ILL.

ALMER COE & COMPANY

Prescription Opticians
Established 1886

10 N. Michigan Ave.

1645 Orrington Ave., Evanston, Ill.

PORTLAND, ORE.

Hal H. Moor, 315 Mayer Bldg.

Guild Optician
Oculists' prescriptions exclusively

N. P. Benson Optical Company

Since 1913

Complete Ophthalmic Rx Service
Including Contact Lenses and Plastic Eyes

MINNEAPOLIS, MINN.

Duluth	Eau Claire	Bismarck
Albert Lea	La Crosse	Aberdeen
Rochester	Wausau	Huron
Winona	Beloit	Rapid City
Brainerd	Stevens Point	Miles City
New Ulm	Ironwood	Iron Mountain
	Bemidji, Minn.	Billings

PHILADELPHIA, PA.

WALL & OCHS OPTICIANS
1716
CHESTNUT ST. PHILA. PA.

Prescription Opticians—since 1890

NUGENT CATARACT VACUUM UNIT

With Improved Erisophake and Oral Valve

Compact, portable, quiet, this dependable little unit produces an even, constant vacuum which can be set at any desired level up to 65 cm. mercury. Wholly enclosed motor and rotary pump are silent, vibrationless; motor has automatic thermal overload protector. Unit requires little attention and is built for long, care-free service. The improved erisophake furnished permits greater ease of application and more perfect manipulation in extraction procedures than formerly; it makes use of the Dimitry shallow suction cup, has Nugent's oral vacuum control valve—most simple, efficient means of control of vacuum during cataract extraction. Handpiece and oral valve are gold plated.

A-4 Nugent Unit complete with erisophake, valve and tubing; for 110 volts, 60 cycles, AC . . . (DC model slightly higher) **$129.75**

Attractive Smooth Crystal Gray Finish

Instrument Makers To The Profession Since 1895

V. Mueller and Company 408 S. Honore St., Chicago 12, Illinois

For Cases of Low Visual Acuity

Spectel
TELESCOPIC
SPECTACLES

with Coated Lenses throughout

Available in two powers. Spectel telescopic spectacles provide retinal image magnification of 1.7 or 2.2 diameters. Experience has shown that they effect substantial improvement in many cases of subnormal vision.

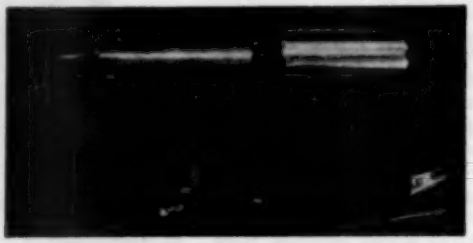
Prescribing Spectel telescopic spectacles is largely an extension of regular refracting routine. Trial sets are neither complicated nor costly. Full details are given in Bulletin 302, which can be obtained from your supplier or direct from us.

KOLLMORGEN *Optical* CORPORATION
2 Franklin Avenue
Brooklyn 11, New York

Distributed in Canada by Imperial Optical Company.

GREEN'S ELECTRIC TREPHINE

IMPROVED MODEL BY DAVID KADESKY, M.D.



The instrument simplifies the operation of trephining for Glaucoma or Corneal Transplantation. Blades are provided with a shoulder that prevents penetration beyond 1.1 mm., and are available in 1½ mm., 4.5, 4.6, 5.5, 5.6, 6.5, 6.6, mm. diameters.

Trephine, case, and two 1½ mm. blades $95.00

PARSONS OPTICAL LABORATORIES, INC.

518 Powell Street San Francisco 2, Calif.

Enlarged to show mesh

Exact size ➤

THE NEW CUTLER-HAMBLIN ALL TANTALUM IMPLANT

The latest Cutler Implant for use in enucleations, re-implantations and eviscero-enucleations is described by Dr. Norman Cutler in the February, 1949 issue of the *American Journal of Ophthalmology* in which he mentions the objectives to be strived for in an ideal implant and prosthesis.

Hamblin's model illustrated herewith is made entirely of Tantalum (a completely inert metal) thereby overcoming the many disadvantages of one made wholly or partly of Plastic. The total weight is 4.3 grammes.

As will be seen in the illustrations, it consists of a ball measuring 17.5 mm. in diameter and 15.5 mm. deep. On the anterior surface is a raised area 12 mm. in diameter and 1 mm. deep, which makes the anterior-posterior length 16.5 mm. The implant is made purposely this size to replace the amount of volume necessarily lost in the removal of the globe and to provide the normal centre of rotation for the prosthesis.

The anterior convex surface of the implant is covered with a fine mesh of tantalum wire behind which is a space sufficient to permit the easy passage of curved suture needles. The adoption of the mesh is the chief feature of the new implant, and the enlarged picture shows the formation of this mesh, which not only offers a larger area for fixation of tissue to the implant but also makes for simplicity in the operation of suturing and more certainty in the fixation.

Price $26.60

THEODORE HAMBLIN, Ltd.

DISPENSING OPTICIANS

MAKERS OF OPHTHALMIC INSTRUMENTS

15 WIGMORE STREET

LONDON W. 1, ENGLAND

Designed by
J. H. Allen, M.D.
and Mr. Lee Allen

The
ALLEN IMPLANT
AND
SPECIAL PROSTHESIS

- Implant is completely buried.
- Flat-backed prosthesis which must be used with this implant has excellent motility, and normal appearance of the lid is achieved.

The above implants and eyes are available from
PRECISION-COSMET COMPANY, Inc.
Makers of Fine Ocular Prostheses and Contact Lenses
234 Hennepin Avenue, Minneapolis 1, Minn.

ELECTRO-MAGNET

• • •

Removes Magnetic
Intraocular
Foreign Bodies

• • •

An excellent and powerful Electro-Magnet capable of easily removing magnetic intraocular foreign bodies from eye. Consists of field coil with central core, selenium rectifier, 3 tips, switch and wiring, in hard wood case.

The magnetic surface is the central core, it has a diameter, size of a dime, but can easily lift up to 40 lbs flat surface.

Tips are steel and nickel plated.

The performance of this magnet compares favorably with others costing much more. Supply limited. Made of high quality government surplus parts. Satisfaction guaranteed or money refunded if returned in 2 weeks. Send check or money order.

ONLY $18.75 POST PAID

Magnetic Specialties Corp. Dept. AJ
25 Park Place **New York 7, N.Y.**

The National Society for the Prevention of Blindness, Inc.
1790 Broadway, New York 19, N.Y.

invites you to become a member and participate in its program of:

1. Supporting basic and clinical research in the blinding eye diseases.

2. Preventive services such as surveys to detect early stages of eye diseases and provision for social service follow-up.

3. Educating the laity and professional groups about need for early and competent eye care.

Subscribing membership entitles you to receive THE SIGHT-SAVING REVIEW, reports of research financed by the Society, and sample copies of new publications. You are also entitled to vote for the Directors at the annual business meeting.

NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS
1790 Broadway
New York 19, N.Y.

To help fight blindness I enclose $..... Please enroll me as a member of the National Society for the Prevention of Blindness. Send me the quarterly SIGHT-SAVING REVIEW and samples of new publications of interest.

Name .....

Address .....

Checks may be made payable to PREVENTION OF BLINDNESS.
Contributions are deductible for purposes of Income, Estate and Gift Taxes.

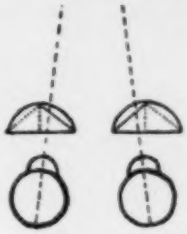
Subscribing Member	$5-$10	Associate Member	$50-$100
Sustaining Member	$10-$50	Donor	$100 and over

Rx ANALYSIS

Pioneered by Austin Belgard

•

ConAcor IS A TECHNICAL IMPROVEMENT!



Bifocal

Glasses

Prism base out at converging point in plus lens neutralized with **ConAcor** Bifocal Segment.

ConAcor has America talking about optical center control: Its precision design assures trial lens comfort at near point. The **ConAcor** lens is a special bifocal originated and developed by Austin Belgard for "individualized" optical center control.

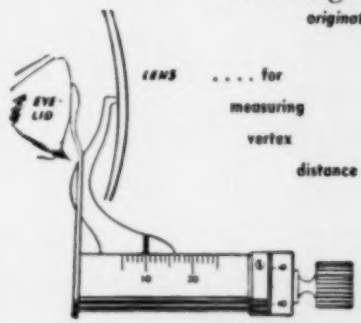
When optical center control is needed for a true translation of your prescription, **ConAcor** is the accepted lens.

Wholesale Rx service to eye physicians and dispensing opticians.

•

The Belgard Lenscorometer

originated by Austin Belgard



Use of Lenscorometer in all cases of Aphakia, + OR — corrections of four diopters or more—a necessity to insure true translation of prescription.

Each $11.75

Austin Belgard Rx OPTICIANS, INC.

Medical Center Office:
1908 Ogden Avenue at Wolcott. (Formerly Belgard, Inc.)

109 N. Wabash, at Washington
9th Floor STate 2-5362

THE AO MONOPLEX EYE

Is a Superior Prosthesis

Here's why:

It is simple enough to speak of quality and to claim experience and craftsmanship; we want to give you facts.

When a suitable plastic material (Methyl-Methacrylate) *first* became available, AO recognized that artificial eyes could be safer and pleasanter to wear. Our prosthetic research was then *concentrated* on the perfection of the plastic eye, and supplemented by the research of leading eye clinics.

Two special presses were developed specifically for Monoplex manufacture. These presses, the electric pneumatic press and the injection molding press, combine to bond the finest grade plastic components (90 screen exclusively) into solid pieces which have no trace of graining; thus allowing highest possible polish and maximum comfort for the patient.

Three dimensional color application procedures plus a special veining technique, using integrated threads to simulate each tiny vein visible on the sclera, achieve a remarkably lifelike appearance.

Finally, and of major importance, is the fact that AO, and the Ophthalmic Dispensers who custom fit Monoplex Eyes, is responsible to *your* exacting professional standards. AO trained Monoplex Technicians can come to your office by appointment to fit difficult cases. Simply contact your local American Optical Company Branch.

Withdrawing the bonded eye from one of 11 pneumatic electric presses in the Monoplex Laboratories of AO's Southbridge Plant.

American Optical
COMPANY